MIDWAY-CLASS AIRCRAFT CARRIERS 1945–92

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ILLUSTRATED BY ADAM TOOBY

NEW VANGUARD 331

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INTRODUCTION

Before, during, and even after World War II, the United States Navy (USN) implemented a ship-building program almost beyond imagination. Arguably, the most important part of this expansive program was its carrier component. In the Pacific War, fleet carriers became the paramount fleet unit. Therefore, construction of the Essex-class fleet carrier was given the highest priority for completion. Eventually, 14 of these 36,000-ton (full load) ships were completed during the war and another nine after it (*see* New Vanguard 130 *US Navy Aircraft Carriers 1942–45* and New Vanguard 310 *Essex-class Aircraft Carriers 1945–91*). Complementing the fleet carriers was a program for nine light carriers and 77 escort carriers commissioned into USN service during the war (*see* New Vanguard 251 *US Navy Escort Carriers 1942–45*). Even the superlative Essex class had limitations, so the USN decided that it needed an even bigger fleet carrier class that emphasized protection and was able to carry an even larger air group, thus increasing its offensive potential. After some debate as to whether the new class was needed as the war drew to a close, construction on the first ship began in October 1943.

Of the six ships projected, only three were ever completed. CVB-41, under construction at Newport News Shipbuilding and Drydock Company, was named *Midway* in October 1944, taking that name from an escort carrier already in commission. As the lead ship, the class took her name. CVB-42, being built at the Brooklyn Navy Yard, was about to be "launched" (the ships were too big to be launched from a slipway so were actually floated out of a drydock) when President Roosevelt died suddenly on April 12, 1945, so the new ship was quickly named *Franklin D. Roosevelt*. CVB-43 was named *Coral Sea* in September 1943 as she was being completed in Newport. CVB-44 was canceled in late 1943 followed by the final two ships in March 1945.

Coral Sea seen in silhouette against a low sun as she arrives at Palma, Spain, during her final Mediterranean deployment in June 1989. (Naval History and Heritage Command)

All three ships were completed quickly despite their immense size, but they were not commissioned until September 1945, and thus missed the war. When the USN was dramatically downsized after the war, all three Midway-class carriers remained in commission. They were the most powerful and largest warships in the world until the first USN "supercarrier" *Forrestal* was commissioned in 1955. As the largest and most capable American carriers of the early Cold War period, they had an important role to play. All three were initially kept in the Atlantic and Mediterranean to conduct presence missions and perform in the nuclear deterrent role against the Soviets.

Franklin D. Roosevelt seen with an unidentified Essex-class carrier and three cruisers in Spanish waters on January 5, 1958. This photo epitomizes the role of the 6th Fleet during the Cold War: exerting American influence and power. (Naval History and Heritage Command)

Large enough to accept significant modernization and to operate the increasingly larger jet aircraft brought into service by the USN, the Midway class was kept in constant service after commissioning. Eventually, all three ships received a first round of comprehensive modernization. *Midway* and *Coral Sea* received additional modernizations which made them equivalent to the Forrestal class. In this sense, they were the USN's first supercarriers. Later in their careers, all three ships saw combat in the Vietnam War and one was active in the 1990 Gulf War. The first ship of the class to leave active service was *Franklin D. Roosevelt* in 1977. *Coral Sea* was decommissioned in 1990. The oldest serving ship was *Midway* which served from 1945 until 1992. She still exists today as a museum ship in San Diego, California.

USN carrier designations

All USN ships receive a type designation. Designations for carriers have evolved since the first carrier *Langley* was commissioned in 1922. The original designation CV denoted a ship designed to operate fixed-wing aircraft. When the Midway-class carriers were approved, their unprecedented size forced the creation of a new designation – CVB (large aircraft carrier). This was approved by the Secretary of the Navy on June 10, 1945. Each ship is also given a hull number. The Midway class was placed in the carrier block, which is numbered sequentially. Thus, CVB-41 became *Midway,* CVB-42 became *Franklin D. Roosevelt,* and CVB-43 became *Coral Sea*.

On October 1, 1952, all CVBs were redesignated CVAs – attack aircraft carriers. As part of a large-scale redesignation of USN ships on June 30, 1975, the three Midway-class units were given the designation CV. This indicated a general-purpose aircraft carrier combining the capabilities of a CVA and a CVS (support aircraft carrier) maximized for antisubmarine warfare. All CVAs, not just the Midway class, were similarly redesignated at this time. This was the final designation of the Midway class when they left active service.

Franklin D. Roosevelt being commissioned at the New York Navy Yard on Navy Day, October 27, 1945. Note the eight 20mm twin mounts on the stern and a Mark 37 director on the ship's port quarter. (Naval History and Heritage Command)

All three Midway-class ships underwent modernization overseen by the Ship's Characteristic Board (SCB) established in 1945 to coordinate the design and construction of USN ships. The SCB assigned numbers to its projects beginning in 1946.

DESIGN AND DEVELOPMENT

Origins of the Midway class

While the USN was very satisfied with the Essex class, and the class was built without regard to prewar treaty restrictions, it was not possible to make all the modifications desired by American designers. As wartime experience demonstrated, the weakness of the Essex class (and all other USN carriers) was the lack of flight deck protection. As a result, many American carriers had been damaged by aircraft-dropped bombs and kamikaze attack during World War II.

This photograph shows *Midway* on her commissioning day of September 10, 1945. All of the primary features of her original configuration are evident. An SX radar is on the mainmast with an SK-2 on the radar mast atop the bridge. The radar mast abaft the stack holds an SR-2 radar. All nine starboard side 5in./54 mounts can be seen, as well as the presence of the original 40mm quad mounts. On the starboard bow is a group of 20mm twin mounts. (Naval History and Heritage Command)

To provide a carrier with adequate flight deck protection while keeping the facilities and space associated with a large air group and to give the ship the offensive punch desired by American naval commanders, a significant increase in the size of the Essex class was necessary. Initially, the size of a new class of carriers with adequate flight deck protection was placed in the 45,000 standard displacement ton range. When operational, commanders

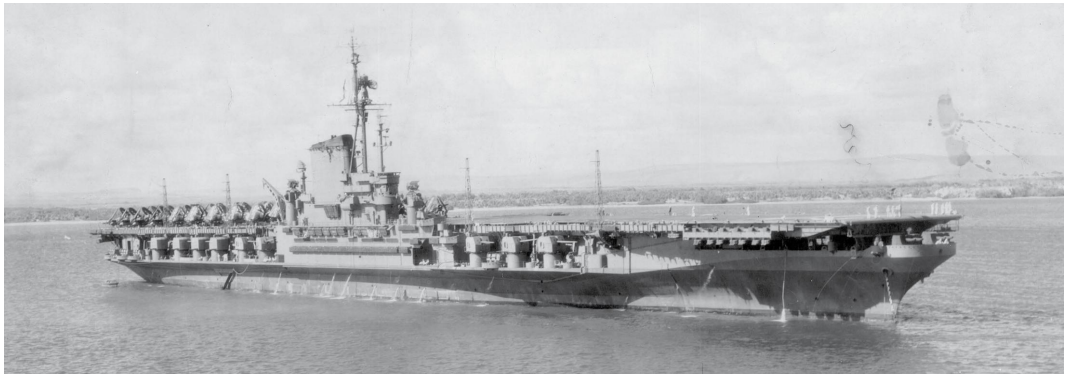
were asked to comment on the viability of such a huge (for its day) carrier, responses were unenthusiastic. In all likelihood, the ships would not be completed in time to see wartime action. Admiral Chester Nimitz commented that it was unwise to concentrate so much of the fleet's striking power in a single hull. Fleet comments indicated that what was really needed was more Essex class ships.

Another issue was whether even 45,000-ton ships could be provided with adequate horizontal protection. Against large bombs, the necessary thickness of the flight deck armor would have to be as much as 7in., something which was impossible to mount so high up on the ship. In any event, placing extensive flight deck armor on a carrier would reduce its stability, and possibly affect speed and maneuverability.

Despite the lukewarm response from the fleet for a massive carrier, Admiral Ernest King, Chief of Naval Operations, persevered with his request for four of the huge carriers as part of the Maximum War Effort shipbuilding program of 1942 for the Fiscal Year (FY) 43 building program. In August 1942, this program was approved by President Roosevelt, but without the four large carriers. As a former Navy man (he was Assistant Secretary of the Navy from 1913–19) and a keen observer of naval affairs, Roosevelt loved to meddle in shipbuilding plans. His efforts were fruitful, since they led to the Navy approving the construction of what became known as escort carriers and also to the austere conversion of nine Cleveland-class light cruisers into light carriers. When the USN proposed a large 45,000-ton carrier, Roosevelt felt it was again advocating for a "gold-plated" design instead of a more useful ship able to be built in large numbers.

In October 1942, Roosevelt gave his conditional approval to the four large carriers, if the Navy could assure him that the need for smaller carriers had been met and that the construction of the large carriers could be accomplished in a quicker manner. The USN's General Board, in charge of approving ship designs, was able to address Roosevelt's concerns regarding other carrier construction, but not on the speed of the delivery of the large carriers. Roosevelt was forced to reach out to a trusted naval officer to get a better read on the projected completion time of the ships, but after getting the answer that they could not be begun until the summer of 1943 (thus making it unlikely they would be ready before the projected end of the war) he remained skeptical. Only after getting the assurances from the director of the

Bureau of Ships in December did he approve two of the large carriers on December 29, 1942 and a third on May 26, 1943.



Franklin D. Roosevelt is seen at anchor in 1946, probably in the Caribbean during workups. Several things are worthy of attention. Note the original tripod mast on which an SX radar has been fitted. The pole mast forward of the tripod carries the SK-2 and the pole mast abaft the stack has an SR-2. Note the full 5in./54 and 40mm batteries, and the presence of six 20mm twin mounts on the starboard bow. Also note the Mark 37 director and a 40mm quad mount forward of the bridge, which took up a large chunk of flight deck space. The 40mm was removed and the Mark 37 moved atop the bridge. (Naval History and Heritage Command)

It is important to remember that when the ships were approved there was no compelling benefit to building large carriers. Early in the war the biggest danger to USN carriers was underwater damage. The Essex class seemed to mitigate this with its alternating engine and boiler rooms layout. Only later in the war was the threat from bombs and kamikaze attack a bigger problem. When these became the primary threat to American carriers, the armored decks of the Midway class looked like a good idea. The huge air groups carried by the Midway class were an obvious advantage on the surface, but the sheer number of aircraft made deck operations inefficient.

Design work on what became the Midway class began in August 1940. Each of the early designs had improved horizontal protection and increased armament to defend against both surface and air attack. The design known as “CV-E” was the largest (45,000 tons standard displacement) and most heavily armored (3.5in. of flight deck armor) and became the basis for the Midway class. The General Board sent it to the Secretary of the Navy for approval on March 14, 1942. The primary attribute of the proposed class in the view of the board was that the increase in displacement and cost was offset by the ability of the heavily protected ships to stay in action after being hit by one or two torpedoes or a few bombs.

After the submission of the design, it underwent further modification before being approved by the Secretary of the Navy on March 21, 1942. The new ships were massively expensive and possessed capabilities greater than any other carrier in the world. Each ship could carry 120 aircraft (36 fighters, 48 dive-bombers, and 36 torpedo bombs) and mounted a main battery of 16 5in. guns. To increase the endurance to the desired 20,000 nautical miles (nm) at 15 kts, more displacement was needed. In turn, this required a larger propulsion plant. The same plant used on the Iowa-class battleships was adopted for the new carriers.

Midway-class construction

The first two ships in the class were built with wartime priorities. Despite the fact that both were completed in a remarkable 23 months, neither was commissioned in time for wartime service. *Coral Sea* took 39 months to complete. Newport News Shipbuilding received a contract for CVB-44, but work never began and no name was assigned. Newport News was also slated to construct the two ships projected for 1945. These were canceled on March 27, 1945 with no work being started.

Midway-class construction

Ship	Built at	Keel laid	Floated*	Commissioned
Midway (CVB 41)	Newport News Shipbuilding and Dry dock	October 27, 1943	March 20, 1945	September 10, 1945
Franklin D. Roosevelt (CVB-42)	Brooklyn Navy Yard	December 1, 1943	29 April 1945	October 27, 1945
Coral Sea (CVB-43)	Newport News	July 10, 1944	April 2, 1946	October 1, 1947

*The ships were too big to be built on slipways. Instead they were built in dry docks and floated out when construction was complete.

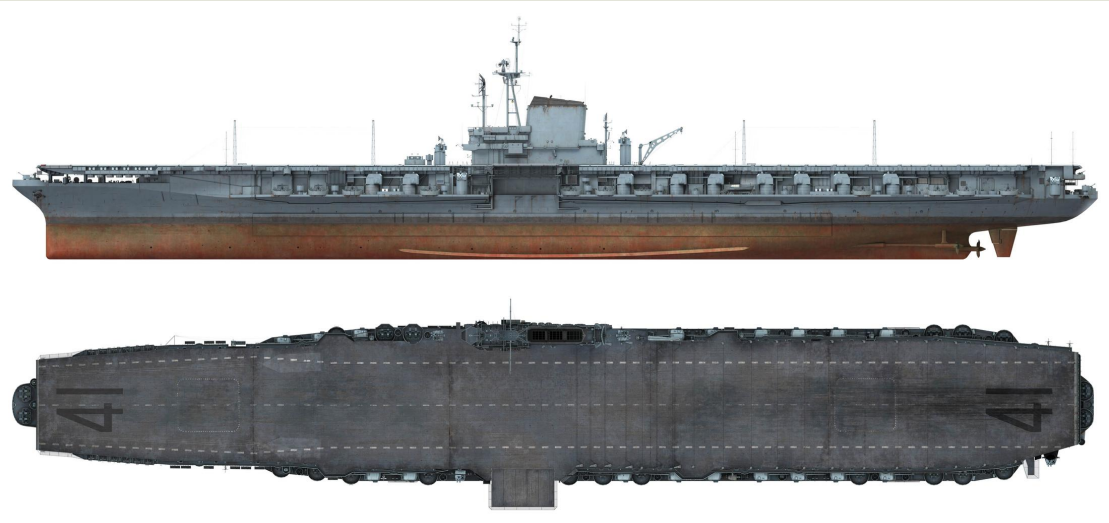
Upon completion, *Midway* projected a massive and powerful appearance. During the design phase, the size of the island was kept to a minimum. Atop the island was a Mark 37 Fire Control Director, a radar pole mast, and a large tripod mast for the heavy height-finder radar. Connected to the island was a huge stack measuring some 50ft long and 60ft high. Abaft the stack was another radar pole mast, another Mark 37 director, and a large aircraft crane. Arrayed along both sides at the gallery deck level were 18 large 5in./54 mounts.

Being the last ship in the class, *Coral Sea* was completed to a modified design. The most visible change was the larger island. The original armored

pilot house was removed, which allowed the forward 5in. fire control director to be moved from its original position forward of the island to atop the island. Two of the 5in./54 mounts were deleted from each side. When completed, the ship did not carry any 40mm mounts, since she was already scheduled for rearmament with the new twin 3in./50 mounts.

Wartime experience showed that even large fleet carriers were vulnerable to typhoon damage. To address this weakness, *Coral Sea* was completed with a partially enclosed bow by extending the side plating up to the flight deck. The other two ships were also fitted with this feature, with *Franklin D. Roosevelt* not getting her modified bow until 1954. This was not the fully enclosed bow later known as a hurricane bow.

A USS *MIDWAY*, INITIAL CONFIGURATION



This plate depicts *Midway* in her original configuration when she was commissioned in 1945. Her port side profile is dominated by the huge stack. The island is small. On the tripod mast atop it is the SX height-finder radar and an SG radar. An SK-2 radar is on the pole mast atop the bridge and the pole mast abaft the stack carries an SR-2. The overhead view shows the huge size of the flight deck. Three elevators have been fitted, two on the centerline. Two catapults are fitted on the bow. Both views show the robust antiaircraft battery. Eighteen 5in./54 mounts are visible. Fire control for these is provided by four Mark 37 directors – one forward of the bridge, one abaft the stack, and two on the port side gallery level. Also present are 21 40mm quad mounts and three groups of twin 20mm mounts.

Midway-class specifications (as completed)	
Displacement	45,000 tons standard; 60,100 tons (full load)
Dimensions	Length: 968ft; Beam: 113ft; draft (full load) 35ft, 9in.
Machinery	12 boilers, 4 geared turbines
Performance	33kts maximum speed; endurance 20,000nm at 15kts
Crew	Ship's company: 106 officers, 2,006 enlisted men; air group: 210 officers, 1,121 enlisted men; flag staff: 14 officers, 126 enlisted men

Machinery

Midway-class powerplants were large and complicated. Twelve Babcock and Wilcox boilers were fitted, each in their own space and outboard of the engine rooms. The boilers operated at 565psi at 850°F. Four turbines drove the 18ft propellers. *Midway* and *Coral Sea* were fitted with Westinghouse turbines, while *Franklin D. Roosevelt* received General Electric turbines. However, the latter proved more troublesome in service. The entire system was designed to generate 212,000shp, but *Coral Sea* recorded 215,520shp on her trials. Design speed was 33kts, which was attained in service.

Bunker capacity was some 9,700 tons of fuel oil which equated to a design endurance of 20,000nm at 15kts. If the ships steamed at full speed, their range would be 4,600nm. In 1946, *Midway* traveled 4,452nm from Guantánamo, Cuba to Rio de Janeiro, Brazil at an average speed of 32.56kts.

Protection

Before it entered World War II, the USN was acutely aware of the potential vulnerability of its aircraft carriers to bombing attack. This was highlighted by the success of German dive-bombers against Royal Navy carriers early in the war. Traditionally, the USN preferred to spend the weight of its treaty-restricted carriers on the space and facilities to carry a large air group, giving the carrier maximum offensive power. It was also thought that mounting deck armor was pointless, since it seemed that with the weight available the flight deck could not be armored sufficiently against bombs. Instead, the main horizontal armor was fitted at the hangar deck level to protect the critical internal areas of the ship. Even though the Royal Navy was providing information on its armored deck carriers and their operations in the Atlantic and Mediterranean, the General Board initially rejected armored flight decks on February 7, 1940.

By the time design work began on the new heavy carrier class in 1941, the benefits of flight deck protection were undeniable. The primary improvement

of what became the Midway class was its flight deck armor, which was 3.5in. thick. This protection did not extend for the entire length of the ship, but it did cover its vital areas. The armored flight deck constituted the ships' principal horizontal protection. The hangar deck had 80lb of splinter plating (about 2in. thick), and the third deck added another 70lb (80lb outboard) of the same.

Other armor protection was also substantial. The main belt was designed to be 7.6in. thick. In May 1943, the starboard belt was reduced to 7in. to make up for the loss of weight on the port side, which had compensated for the weight of the island. The fore and aft ends of the armored box were 6.3in. thick. The conning tower was heavily protected with 6.5in. on the side and 3.5in. on the top. The steering gear was outside the armored box, so this received its own armored protection of 7.6in. on the side, 5in. on the top, and 6.3in. fore and aft.

Underwater protection was also considerable. The side protection system, designed to defeat torpedoes, featured four layers to absorb the shock of an external explosion. The outer layers were fuel tanks and two floodable damage-control voids comprised the inner layers. Between the inboard voids and the ship's interior was a 1.25in. thick bulkhead of high tensile strength steel to act as a splinter protection layer. A double bottom was fitted to provide protection against mines.

Midway-class carriers were designed first and foremost to operate a large air wing. When commissioned, they could carry some 130 aircraft, far more than any other carrier ever built. The USN's practice of using a deck park contributed to the huge size of the air wings on its carriers. This is *Franklin D. Roosevelt* soon after being commissioned with most of her air wing of Corsairs and Helldivers on deck. (NARA)

Another area of improvement compared to the preceding Essex class was increased subdivision. There were 26 watertight transverse subdivisions below the second deck. The machinery arrangement was also modified for greater survivability compared to the Essex class. The engine rooms and boiler rooms were separated and placed in a larger number of compartments.

The design featured 12 separate boiler rooms feeding four separate machinery rooms. Each of the four machinery rooms could operate independently and the inboard and outboard plants were cross connected. Another ten separate auxiliary spaces were provided for pumps, generators, evaporators, and auxiliary machinery rooms. Overall, the subdivision scheme was like that of the never-built Montana-class battleships, which were designed at the same time as the Midway class. The downside of all this subdivision was that spaces were small and the ships gained a reputation for being uncomfortable.

Aircraft facilities

American carriers were designed around a large air group and the facilities to operate it quickly and efficiently. As envisioned, the Midway class was to carry a huge air group of 144 aircraft. This was much larger than the aircraft complement of any World War II aircraft carrier of any nation. On the surface, the benefits of a larger air group are obvious. However, carriers of the era were unable to launch and recover aircraft simultaneously. This had a direct impact on the efficiency of operating aircraft. In the case of the huge Midway-class air groups, the time required to launch large strikes and then recover them was excessive, since for that entire time the ship was required to steam into the wind, which increased the carrier's potential vulnerability.

Aircraft capacity was reduced early in the design process when the new class came in badly overweight. As a result, the requirement for 25 percent spare aircraft was eliminated. Of course, the actual number of aircraft carried depended on the type of aircraft. In general, as the war progressed, the aircraft required were bigger than previous designs. When the ships were completed, they possessed a capacity for operating 137 aircraft.

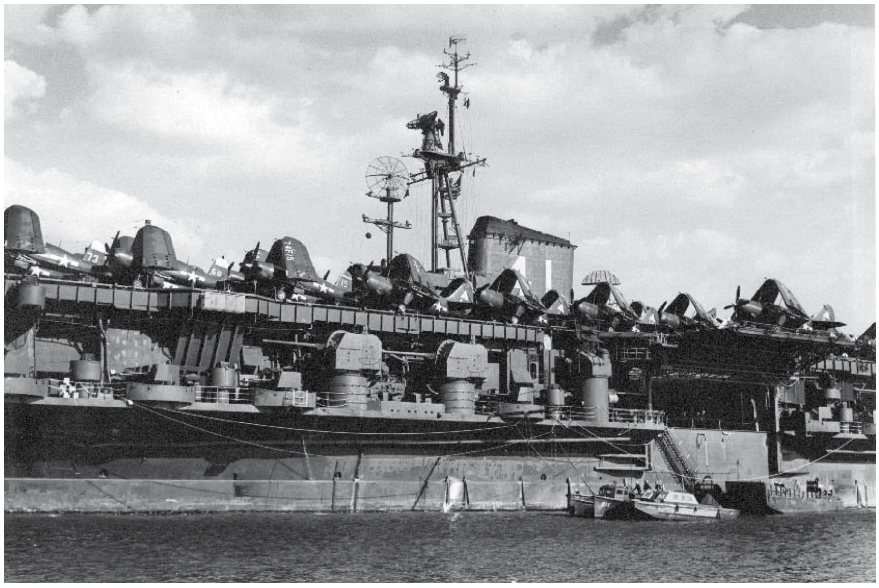
The sheer size of the Midway class did offer clear advantages. The flight deck was huge – 2.8 acres overall with a length of 932ft and 113ft wide. The longer flight deck permitted the fitting of the more powerful H 4-1 catapult. The extended catapult length could accelerate larger and heavier aircraft to launch speed. Three elevators, two center lines, and one deck edge, moved aircraft down to the 764ft long and 92ft wide hangar deck. Hangar deck height was 17ft 6in., large enough to accommodate any aircraft of the period. Like all previous USN carrier classes, the Midway class retained an open hangar design. This feature allowed aircraft to be warmed up in the hangar deck, which reduced the time required to launch a large strike. Each ship was

designed to carry 3,369 tons of aircraft ordnance and 332,000 gallons of aviation fuel.

Midway-class weapons

Since they were designed during the war, the Midway class was envisioned to carry an antiaircraft battery consisting of the USN's wartime standards. Eighteen 5in. single dual-purpose mounts (either 38 or 54 caliber) were planned, including two twin mounts in front of the island. Two quadruple and 12 twin 40mm Bofors mounts were originally to be fitted for intermediate antiaircraft protection. As the importance of antiaircraft protection became more apparent, four more 5in. guns were added. The guns forward of the island took up a lot of flight deck space, so they were moved down to gallery level where the rest of the 5in. battery was located. This configuration meant that flight operations would not have to be halted if the deck-mounted 5in. guns were in action. In January 1943, the final configuration of the new class was decided upon. The main battery was 18 5in./54 single mounts, all fitted on pedestals on gallery level. Fire control was provided by four Mark 37 directors – two on the island and one on the port side and hangar deck level.

As was the case for all USN World War II ships, the war years saw the extensive growth of light antiaircraft guns on large warships. Accordingly, the 40mm battery on the Midway class was expanded. On January 20, 1943, 15 quadruple Bofors mounts were planned. Two were positioned on the bow, two on the stern, and one on the flight deck in front of the island with the rest on the port and starboard galleries. In the summer of 1944, six more were added, all on the galleries (one on the starboard side and five on the port side). Twenty twin 20mm mounts were fitted on the first two ships when they were completed.



This close-up view of *Midway*'s port side shows two of her 5in./54 mounts. This weapon replaced the very successful 5in./38, but it suffered problems after entering service and was never considered a full success. The Midway class was the only USN class to carry the 5in./54 Mark 16 gun. Their placement on the gallery level was meant in part to protect the hangar deck from aircraft crashing into it. Also note the port side Mark 37 director that was soon removed. (Naval History and Heritage Command)

B THE AJ-1 ON *CORAL SEA*

Coral Sea was the first carrier to operate the AJ-1 Savage nuclear-capable bomber. This view shows four AJ-1s conducting carrier qualifications in 1951. It is obvious why these large aircraft were not popular on carrier decks. *Coral Sea* was different from her two sister ships when she was completed. In this view, her larger bridge is apparent as is her smaller 5in./54 battery. The Mark 37 directors for the main battery have been fitted with the Mark 25 radar and the director on the port quarter is not present. After being completed with no secondary guns, *Coral Sea* now has her complete battery of 20 3in./54 mounts. Note a few remaining 20mm twin mounts on the stern. An SR-2 is on the pole mast abaft the stack, and an SX height finder remains on the tripod mast.

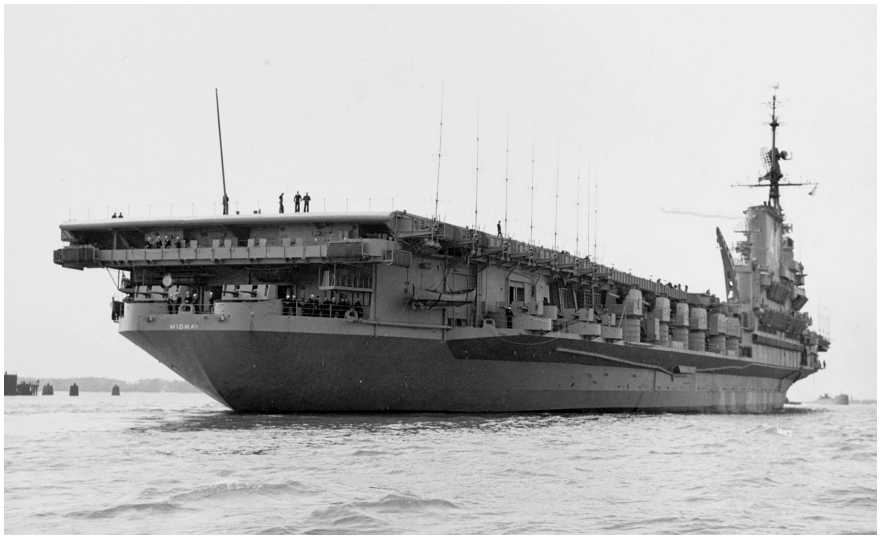
The Midway class was the first to be fitted with the 5in./54 mount. This replaced the ubiquitous 5in./38 dual purpose gun. The new 5in./54 gun promised to be an improvement over the 5in./38, as it fired a heavier round over a greater distance and still maintained the same rate of fire. In service, it was a disappointment with rate of fire and reliability issues. Each mount carried a single gun and weighed about 25 tons each. Nine were carried on each beam. As the ships aged, the effectiveness of conventional guns became questionable and the 5in./54s were gradually removed. Nine were used to arm the Japanese Maritime Self-Defense Force's Murasame and Akizuki-class destroyers commissioned in the late 1950s and early 1960s. Fire control for the 5in./54 battery was provided by Mark 37 directors with the Mark 12/22 radars. By 1950, the Mark 25 radar was fitted on the Mark 37s. The Midway class was the only class of USN ships to carry the 5in./54 Mark 16 gun on the Mark 39 mount.

Midway-class weapons

System	Shell size	Rate of fire	Maximum range
5in./54	70lb	18 rounds per minute (rpm)	25,900yds
40mm Bofors	2lb	160rpm	11,000yds
3in./50	24lb	45–50rpm	14,600yds
Mk-15 Phalanx CIWS	20mm shell	4,500rpm	*c*. 4,000yds
BPDMS	Sea Sparrow air-to-air missile	8 missiles per Mark 25 launcher	*c*. 7,000yds

Coral Sea was completed with only 14 of the 18 5in./54 guns fitted on the first two ships. As a weight-saving measure and because the effectiveness of the 5in./54 against modern threats was very questionable, each of the three ships shed their mounts over time. By 1955, *Midway* was down to ten and by 1963 to only four. After her second major modernization in 1970, just three remained. In 1979, these were also removed.

Franklin D. Roosevelt was completed with 18 5in./54 mounts, but she had four removed by 1950. After her 1954 modernization, only ten were left. In her final modernization in 1969, only four 5in./54s remained, one on each quarter.



This starboard quarter view of *Midway* is from April 1947. The full 18-mount 5in./54 battery is still present, as are the original 40mm quad mounts. Note the 20mm twin mounts on the stern. (Naval History and Heritage Command)

Franklin D. Roosevelt during her second Mediterranean deployment in November 1948. The Mark 37 director has been moved to atop the island and the number of 5in./54 mounts have been reduced from 18 to 14. (Naval History and Heritage Command)

Coral Sea's gun configuration prior to her first major modernization in 1957 was ten 5in./54s (seven along the port side gallery and three on the starboard side) and 16 twin 3in./50s (ten on the port side, six on the starboard side). After her first major modernization, only six 5in./54 mounts remained. By 1977, only three 5in./54s were still aboard; three years later she had none.

Only the first two ships were completed with the full 21 40mm quad mounts for a total of 84 40mm guns. *Coral Sea* was not fitted with any 40mm guns when completed, because she was scheduled to receive the new twin

3in./50 mounts in May 1949. Kamikaze attacks late in World War II demonstrated the inadequacy of the 40mm guns in terms of providing stopping power against onrushing suicide aircraft. In response, the USN developed the 3in./50 twin mount that possessed a high rate of fire and could fire a proximity round. The first of these guns entered service in 1948, replacing the 40mm quad mount. Despite the fact that the 3in./50 fired a larger shell and possessed a high rate of fire, it proved disappointing in service and was beset by reliability issues. When the Midway class received its 3in./50 mounts, 20 were fitted (two on the bow, ten on the starboard side, six on the port side, and two on the stern). The first round of modernization on *Franklin D. Roosevelt* reduced the 3in./50 battery to eight. *Coral Sea*'s first modernization included the removal of all her 3in./50 mounts. By about 1960, the other two ships had had all their 3in./50 mounts shipped ashore.

Coral Sea in 1948 with an all-propeller air group. The Skyraider has already replaced the Helldivers. Note that the ship was completed with only 14 5in./54 mounts, as only seven are visible on the starboard side. The secondary battery is vacant until the new 3in./50 mounts can be installed. (Naval History and Heritage Command)

All ships of the class were fitted with 20 twin 20mm mounts when completed. They had all been removed by 1950.

The threat level from Soviet high-speed, sea-skimming antiship missiles grew in the late 1960s, forcing the USN to begin work on point defense weapons to replace the ineffective gun batteries. Traditionally, USN carriers relied on their aircraft or their escorts to neutralize threats, but leaving the high-value carriers virtually undefended against modern threats was not

acceptable. To counter the growing antimissile threat, the Basic Point Defense Missile System (BPDMS) was developed using the existing Sparrow AIM-7E radar-guided missile (renamed Sea Sparrow in its new role) and marrying it to a modified antisubmarine rocket launch box to provide a very rudimentary defense against antiship missiles. The system had reliability issues and was short ranged. Only *Midway* received the BPDMS with two being installed in 1979. *Nimitz* was also equipped with BPDMS when the author was aboard and for many target shoots the Sea Sparrows never left the box.

A much more significant improvement in the antiship missile defense capabilities of *Midway* and *Coral Sea* was provided by the deployment of the Phalanx Close-In Weapons System (CIWS). This last-ditch defensive system designed to defeat antiship missiles entered fleet service in 1980. It used a 20mm 6-barrel Gatling gun with a theoretical rate of fire of 4,500rpm. Phalanx is a self-contained system with its own radar and is capable of acting in an autonomous mode. *Coral Sea* was the first USN ship to receive a permanent installation of the CIWS. She was fitted with three in mid-1980. *Midway* received two of these in 1984, one on each beam.

Midway-class radars

USN carriers of the early Cold War period had a variety of radars for different purposes. Most radars were devoted to air search. The standard air-search radar for large USN ships at the end of World War II was the SK series, with the SK-2 being the most numerous. The SK-2 was to be replaced by the SR series, which was a direct predecessor to the SPS-6 that became the standard air-search radar in the early postwar period. In addition, the SR-2 was often fitted as a backup air-search radar, because it operated on a different wavelength.

Any USN carrier is only part of a larger battlegroup. This explains why the Midway-class carriers were virtually unarmed in the later phases of their careers. In this view, *Midway*'s battlegroup is seen in 1980 while operating in the Indian Ocean. Among the combatant escorts are *England* (a Leahy-class guided-missile cruiser), *Elliott* (a Spruance-class destroyer), *Robison* (an Adams-class guided-missile destroyer), and *Downes* (a Knox-class frigate). Two supply ships bring up the rear of the formation.

Coral Sea makes a high-speed turn on July 28, 1955 in the Mediterranean. This is before her first major modernization, but some changes are already evident. The bridge has been expanded and the 40mm mounts have been replaced by 3in./50 mounts. The electronics fit includes an SPS-6 and an SPS-8A; on the pole mast abaft the stick is an old SC-2. The Mark 37 director has received a Mark 25 radar. Banshees, Panthers, and Savages can be seen on her flight deck. (Naval History and Heritage Command)

The pace of USN radar development was rapid during the early Cold War period. The SPS-6 series radars displayed major deficiencies and were quickly replaced by the SPS-12 in 1953. As a result, *Coral Sea* retained the long wavelength SK-2 radar. The largest air-search radar fitted aboard a Midway-class ship was the SPS-37 with its 42ft wide antenna. Introduced in 1960, it possessed a detection range up to 300nm. *Midway* and *Coral Sea* received the SPS-43, which was an improved SPS-37, but was externally indistinguishable. The first true 3-D air-search radar aboard a Midway-class ship was the SPS-48. Finally, the SPS-49 long-range 2-D air-search radar replaced the SPS-37/43.

Height-finder radars were essential for fighter control. The World War II-era SP was replaced by the SX at the end of the war. Later height finders consisted of the SPS-8 and finally the SPS-30, first delivered in 1962. The introduction of 3-D air-search radars ended the need for a separate height-finder radar.

The very successful wartime SG surface-search radar was replaced by the SPS-10. It was a reliable radar and multiple versions were deployed, including on all three Midway-class ships.

As designed, the electronics suite of the Midway class was to include two SK air-search radars, two SG surface-search radars, and an SM height-finder radar. These were placed on the island in two pole masts and a large tripod mast with clear arcs to avoid the problem of interference.

Midway was completed with SK-2 and SX height finders located on the top of the tripod mast. *Midway* was one of the first ships to carry the new SX radar. In addition, the SR-2 was fitted as a backup air-search radar, because it operated on a different wavelength. By 1952, the original tripod mast atop *Midway*'s island was replaced with a lattice tripod on which the SPS-8A height-finder radar was fitted. Two SPS-6 air-search radars were also retained.

Franklin D. Roosevelt's configuration changed little from the 1960s until her retirement in 1977. Note the presence of only two 5in./54s on the port side; no 3in./50 mounts remain. The Mark 37 director has been moved atop the bridge. The ship's electronics suite includes an SPS-30 on the mainmast with an SPS-10 mounted above it. The large SPS-43 had been fitted on its own platform on the starboard side of the stack. The air wing includes F-4, F-8, A-4, A-1, A-3, and E-1 aircraft. (Naval History and Heritage Command)

Franklin D. Roosevelt carried a similar electronics package. In 1947, she carried an SK-2 on the radar mast above the bridge, an SX on the tripod mast, and an SR-2 abaft the stack. By 1952, she was fitted with the standard suite of two SPS-6 air-search radar and an SPA-8A height-finder radar.

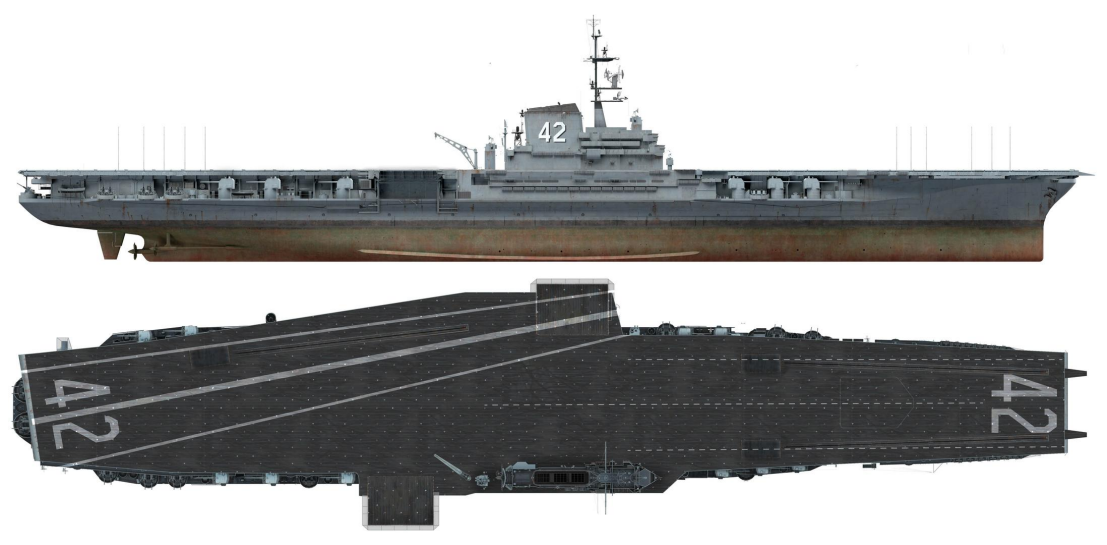
Coral Sea was commissioned with an SK-2 and SR-2 for air search and an SX height finder. The SR-2 was replaced with an SPS-6, but the older SK-2 was retained until 1957. The newer SPS-8A replaced the SX.

By the 1960s, new electronics had reached the fleet. By 1961, *Midway* was fitted with the long-range SPS-43 and the SPS-8A for air search, complemented by the SPS-12 height finder. Just two years later, the improved SPS-30 height finder joined the SPS-43. By 1981, *Midway* carried two air-search radars (SPS-37A and SPS-48A) and retained the SPS-10 for surface search. Her final electronic configuration included the SPS-48C 3-D air search, the SPS-49 long-range 2-D air search, and the SPS-65 navigation radar.

Franklin D. Roosevelt did not receive continuous electronics modernization during her career. In 1956 she carried the SPS-8A air-search

radar, the SPS-12 height finder, and photos reveal that she also, surprisingly, retained an old World War II-era SC-2 air-search radar. From 1965 until her decommissioning, she carried the SPS-43 and SPS-30 radars – she was the last ship in the fleet to use the SPS-30.

C USS *FRANKLIN D. ROOSEVELT* AFTER HER FIRST MODERNIZATION



Franklin D. Roosevelt is depicted here in 1956 after she received the SCB 110 modernization. The most obvious changes are the addition of the angled deck and the hurricane bow. The overhead profile shows the new locations of the three elevators and the three catapults. Other structural changes included enlargement of the island. A new tubular mast on the island carries the new SPS-8A and SPS-12 radars. The antiaircraft battery has been much reduced and now consists of ten 5in./54 and eight 3in./50 mounts.

In 1960, *Coral Sea* was fitted with the SPS-37 for air search and two height finders (SPS-8A and SPS-12). By 1963, the SPS-43 had replaced the SPS-37 and the SPS-30 had replaced the SPS-8A. From 1967 to 1978, *Coral Sea* was fitted with the SPS-43A for air search, an SPS-30 for height finding, and an SPS-10 for surface search. Her final configuration mirrored that on *Midway*: an SPS-48C 3-D air search, an SPS-49 air search, and an SPS-65 navigation radar.

Principal Cold War Midway-class radars

Radar	Purpose	Maximum range
SK-2	air search	100nm
SX	height finding	70nm
SPS-6A/B/C	air search	70–140nm (against large targets)
SPS-8A/B	height finding	72nm (actual)
SPS-10	surface search	8nm (against a periscope-sized target)
SPS-12	height finding	70–90nm (actual)
SPS-30	height finding	240nm (theoretical)
SPS-37A	air search	233–300nm (actual)
SPS-43A	air search	233–300nm (actual)
SPS-48	3-D air search	220nm plus
SPS-49	air search	256nm

Midway-class modernization

During their careers, each of the Midway-class ships was extensively modernized. The initial modernization was the CVB Improvement Program Number 1, which was approved in May 1947. The intent of the program was to give the ships the ability to operate jet and heavy attack aircraft. The flight deck was reinforced for the P2V Neptune and AJ-1 Savage. A space for the assembly of nuclear weapons was added to each ship and every carrier received an interim hurricane bow. Four of the 5in./54 mounts were removed from *Midway* and *Franklin D. Roosevelt* to compensate for the extra weight.

More extensive modernization was required to keep the World War II-era carriers viable as jet aircraft entered service. Early jet aircraft lacked the acceleration necessary for rolling take-offs, so they had to be launched by catapult. Larger and heavier aircraft meant that more powerful steam catapults were necessary. Jet aircraft had higher landing speeds, so heavier

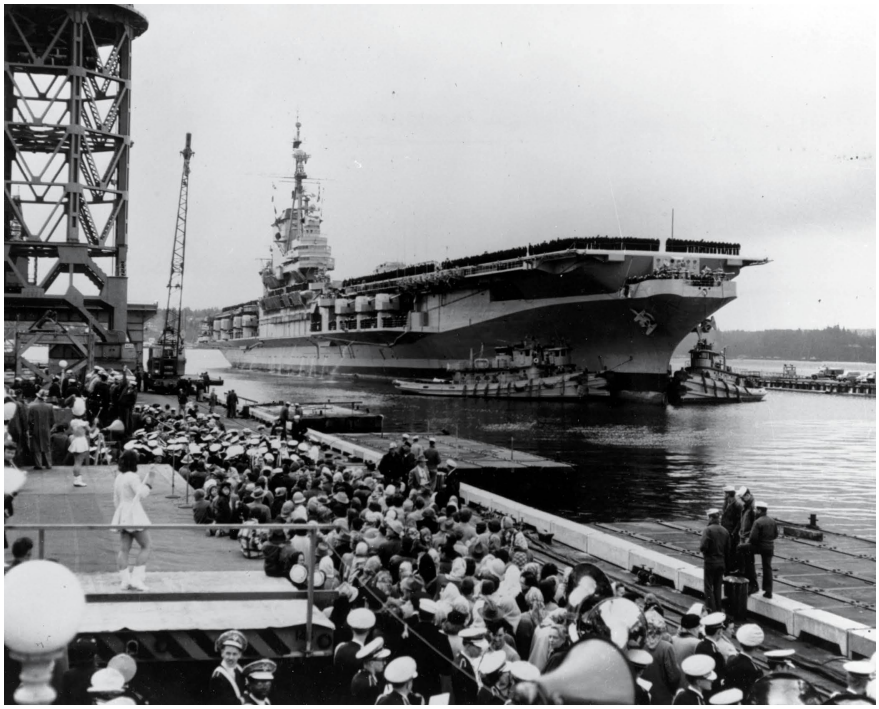
and more powerful arresting gear was required. Jets burned fuel at a higher rate, so an increased aviation fuel storage capacity was needed.

Coral Sea returns to Alameda in March 1982 after a Western Pacific deployment. The SPS-30 height-finder radar and the large rectangular SPS-43A radars are prominent on the mainmast. *Coral Sea* operated the last SPS-30s in the fleet. Note the Phalanx CIWS fitted above the bridge. (Defense Media Activity Center)

In addition to the assembly spaces required for nuclear weapons, weapons elevators had to be able to lift them. Magazine capacity for conventional and nuclear weapons required expansion.

All of these changes could be made to Midway-class carriers without huge modifications. However, incorporation of angled decks required an extensive yard period. Without angled decks, high-speed jet operations were simply too dangerous. When jet aircraft incorporated swept wings, their air speed increased making landings on straight-deck carriers increasingly perilous. On a straight-deck carrier, aircraft would either recover safely by engaging one of the arresting wires or hit the crash barrier, which was always rigged to protect aircraft parked forward. Using an angled deck, the landing aircraft immediately applied full power after hitting the deck to take off again if an arresting wire was not engaged. Aircraft either landed safely or went around for another try. The USN began to examine the feasibility of the angled deck concept in 1952 using *Midway* as a test platform and fitted an experimental angled deck on Essex-class carrier *Antietam* in 1952. All three Midway-class

carriers were fitted with an angled deck during their first major modernizations.



Franklin D. Roosevelt arrives at the Puget Sound Naval Shipyard to begin her SCB 110 modernization in March 1954. She was the first of her class to receive a major modernization. When it was completed two years later, *Franklin D. Roosevelt* was the most modern and powerful carrier in the USN and the world. (Naval History and Heritage Command)

Only the Midway class was able to operate postwar aircraft large enough to carry nuclear weapons. For this reason, they were kept in service constantly without the opportunity for major modernization. Beginning in 1954, they were given their first modernization since being completed. The first was *Franklin D. Roosevelt*, which underwent work at Puget Sound on May 1, 1954. *Midway* received her first major work commencing on September 1, 1955; *Coral Sea* followed on April 16, 1957.

The Korean War brought massive increases in naval funding and part of that was allocated to the first major Midway-class modernization. Work was included as part of the FY 54 program and the work was given the designation SCB 110. Much of the work paralleled that already being done to the Essex class. The projected cost of the modernization was $35 million in 1952, not including the cost of new electronics which was drawn from a

different program. The actual cost for the first ship to undergo the process came to $48 million.

Franklin D. Roosevelt was the first to undergo the SCB 110 program. Structural work included the addition of a hurricane bow, an enlarged bridge, and, most significantly, a new 531ft long angled flight deck. Improvements to the aviation facilities consisted of a new C-11-2 steam catapult on the angled deck and two C-11-1 steam catapults on the bow, new Mark 7 Mod 1 arresting gear (five arresting wires and two barricades), and a Fresnel mirror landing system. The aft elevator was relocated to the starboard deck edge, the forward elevator was enlarged, and all elevators were increased to a 74,000lb capacity, which made them capable of handling the A3 Skywarrior bomber that was just coming into service. Aviation fuel capacity was increased to 450,000 gallons. A fully enclosed primary flight control was installed on the aft end of the island.

Combat system improvements included the addition of SPS-8 and SPS-12 radars. On *Franklin D. Roosevelt* these were placed on a new tubular mast; on *Midway*, they were fitted in a new trellis mast above the island. Damage control improvements included two new hangar bay doors which could divide the hangar deck into three hangar bays. Other improvements were made to the fire suppression system.

To compensate for the extra weight, the antiaircraft battery was reduced to 10 5in./54 mounts and eight 3in./50 mounts. The 3,200-ton armor belt was removed. Another measure to maintain stability was the addition of hull blisters which increased the ship's beam from 113ft to 121ft. After the completion of all work, standard displacement rose to 44,950 tons and full load displacement to 63,500 tons.

Principal Midway-class modernizations

Work	SCB 110	SCB 110A	SCB 101.66
Ships receiving	*Franklin D. Roosevelt, Midway*	*Coral Sea*	*Midway*
Tonnage (standard/full load)	44,950/63,500	45,100/62,600	47,895/64,714
Length (including catapult booms)	977ft, 2in.	978ft	1,001ft, 6in.
Beam (hull/with flight deck)	121/210ft	121/231ft	121/258ft, 6in.
Flight deck size	977ft, 2in. × 192ft	978ft × 236ft	972ft, 2in. × 258ft, 5in.
Angled deck length	531ft	663ft, 6in.	651ft
Elevators/capacity	3 56 × 44ft/74,000lb	3 56 × 44ft/74,000lb	3 63 × 52ft/110,000lb
Catapults	3 C 11 (2 bow, 1 waist)	3 C 11 (2 bow, 1 waist)	2 C 13

Weapons	10 5in./54, 8 twin 3in./50	6 5in./54	3 5in./54
Complement (ship's company and air wing)	412 officers, 3,648 enlisted	317 officers, 4,058 enlisted (1978)	360 officers, 4,326 enlisted
Speed	30.6kts	32kts	31.6kts

Coral Sea's modernization was part of the FY 57 program and was given the designation SCB 110A. Work began on April 16, 1957 and was completed on January 25, 1960. The SCB 110A program was similar to the SCB 110 but was more extensive in some respects. The angled deck was bigger with the port side elevator taken off the angled deck and moved aft. The forward centerline elevator was removed and a new one added on the starboard side forward of the island. All the elevators could handle aircraft up to 74,000lb. A third C 11 catapult was added on the angle deck to complement the two on the bow. The Mark 7 arrestor system was added.

A new mast was placed atop the island to handle the updated electronics suite. The 5in./54 battery was reduced to only six guns and all the 3in./50 mounts were removed. The interior of the ship was air conditioned by the distribution of 30 air conditioning plants throughout the ship – this alone added 852 tons. To compensate for the extra weight, the hull was fitted with bulges bringing the beam to 121ft. The caused a slight drop in speed to 32kts.

The size of aircraft kept increasing and the Midway class was handicapped by its 17ft 6in-tall hangar deck and the C 11 catapults. This prompted another round of modernization to allow the class to handle the latest aircraft. The first work was included in the FY 66 program.

Midway was the first to undergo this new work designated SCB 101.66. The work was extensive and was budgeted at $84.3 million. The centerline elevator was removed and a starboard-side elevator added, as on *Coral Sea*. Two bow C 13 catapults replaced the previous three C 11 catapults. In addition, Mark 7 Mod 3 arresting gear was fitted. Aviation fuel capacity was increased to 1,200,000 gallons. An inertial navigation system and the Naval Tactical Data System were also added. Much to the delight of the crew, the ship received central air conditioning. Work was completed on January 31, 1970; however, the final price was $202 million, well over the original budget of $88 million.

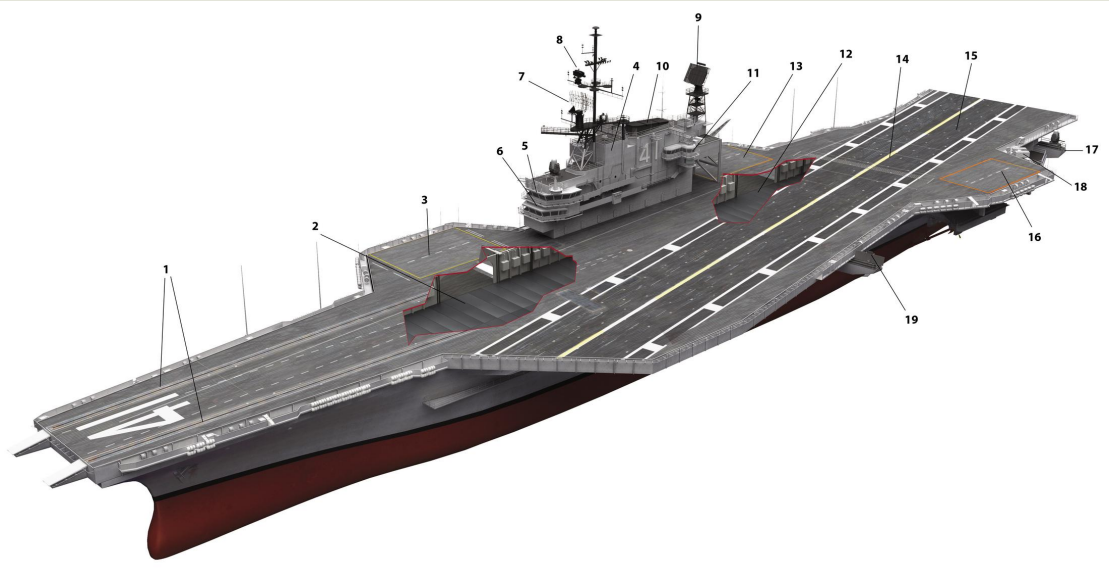
This June 1963 view of *Midway* shows many of her SCB 110 modifications. The hurricane bow and an angled deck are clearly seen, and the bridge has been enlarged. By this point, the electronics suite has been updated with the addition of the SPS-43 radar outboard of the stack and an SPS-30 height finder on the mainmast. The air group has also been updated, and now includes F-4B Phantoms and F-8 Crusaders. (Naval History and Heritage Command)

Flight deck size went from 2.82 to 4.02 acres, and the angle of the flight deck landing area was increased to 13.5°. The elevators were enlarged and were rated to lift up to 110,000lb. When *Midway* was recommissioned on January 31, 1970, she was a much more capable ship and was expected to have a service life of another 20 years. However, the modernization work was not a total success, since the modifications had worsened the ship's seakeeping capabilities and ability to conduct air operations in rough seas.

The price of the SCB 101.66 on *Midway* prevented *Franklin D. Roosevelt* from receiving the same work. Instead, she received the austere SCB 103.68 modernization. Her centerline elevator forward was replaced by a deck edge elevator on the starboard side. The C 11 catapult on the angle deck was removed and the two C 11 bow catapults retained, instead of the more powerful C 13. To improve habitability, the crew spaces were refurbished,

including improved air conditioning. All 12 boilers were overhauled. The ship's armament was reduced to four 5in./54s, two per side controlled by three Mark 56 directors and one Mark 37 retained atop the bridge. This work was completed in July 1969.

D USS *MIDWAY*, FINAL CONFIGURATION



KEY

1 C 13 steam catapult (2)
2 Hangar bays 1 and 2
3 Elevator 1
4 Island
5 Navigation bridge
6 Flag bridge
7 SPS-49 air-search radar
8 SPS-65 navigation radar
9 SPS-48C 3-D radar
10 Stack
11 Primary flight control
12 Hangar bay 3
13 Elevator 2
14 Aircraft crash barrier (recessed position)
15 Arresting wire (4)
16 Aircraft elevator 3
17 Phalanx CIWS Mk 15
18 Eight-cell Sea Sparrow Mk 25 launcher
19 Mirror landing system

Midway served 47 years as a front-line carrier and fought in two wars. During this time, she underwent two extensive modernizations and another period of major work when stationed at Yokosuka. At the end of her career she was still able to carry a large air wing and operate the most modern aircraft in the USN's inventory. This is the ship in her final configuration and as she appears now as a museum ship in San Diego.

This April 1971 photograph shows *Midway* after her SCB 101.66 modernization. A host of upgrades were made, but the obvious changes to her appearance include the new elevator forward of the island and the larger flight deck. Note the alert package on or near the bow catapult of one E-2 and two F-4s. (Naval History and Heritage Command)

Midway had one more extensive modernization. The work was conducted at Yokosuka in Japan, making it the largest modernization not performed in a naval shipyard in the United States. Objectives included preparing the ship for F/A-18 Hornet operations and to address the problems created after *Midway*'s 1970 modernization. *Midway* entered drydock on March 31, 1986 and the Japanese lead contractor, Sumitomo Heavy Industries, began work that was scheduled to take seven months.

Most challenging was the work designed to increase the ship's hull strength and restore the original draft. This would be accomplished by adding a keel strake, increasing the girder strength of the hull, and fitting a 10ft wide hull blister for 70 percent of the ship's length. To operate the Hornet, new jet blast deflectors were installed, the catapults were modified, and the aircraft maintenance shops were converted to support the new aircraft.

The Japanese workforce finished the modernization three days early and under budget. At the end of the work, which cost $50 million, *Midway* was able to operate Hornets. However, the installation of the hull blister was flawed, not due to the work of the Japanese, but because engineers at Naval

Sea Systems Command had botched their calculations. As a result, the ship's 20ft-wider hull took on new sea-keeping characteristics. The predicted roll period was 13.5 seconds; instead, it was an alarming 12 seconds. Thus when *Midway* encountered a 12-second beam sea, the ship rolled badly. During trials in December 1986, the ship rolled up to 10° at a moderate speed in only 4–6ft seas. Water was taken over the flight deck. During a typhoon in the Sea of Japan in October 1988, *Midway* recorded a 26° roll. This was very concerning, since the ship was designed to sustain no more than 24° of roll. Flight operations were difficult or impossible when the ship was rolling heavily. Maneuvering into or out of the beam sea solved the problem, but it was a constant issue that *Midway*'s crews were forced to deal with until her retirement.

OPERATIONAL HISTORIES: 1945–92

Midway

The lead ship of the class had the longest career – 47 years – and fought in two wars.

***Midway* milestones**			
Service dates	**Conversions**	**Classifications**	**Fate**
Commissioned: September 10, 1945 Decommissioned: October 14, 1955 Recommissioned: September 30, 1957 Decommissioned: April 11, 1992	SCB 110 (September 1955–September 1957 SCB 101.66 (February 1966–January 1970)	CVB 41 (as commissioned) CVA 41 (October 1, 1952) CV 41 (June 30, 1975)	Museum ship, San Diego, California since August 2003

Following her commissioning, *Midway* was assigned to the Atlantic Fleet and homeported in Norfolk, Virginia. In September 1947, *Midway* was used as an underway launch platform for a captured German V-2 rocket. The launch was successful in that it did not blow up on the flight deck, but the idea was not pursued further. The following month, *Midway* conducted her first deployment to the Mediterranean. During most of the Cold War, the Mediterranean was a volatile region and the center of superpower naval competition. Accordingly, the USN committed to keeping at least two carriers constantly in the region. From the Eastern Mediterranean, aircraft from her decks could strike the Soviet Union with nuclear weapons. As the USN's most capable carriers, early Cold War operations of the Midway class centered on the Mediterranean.

Midway air groups

During her long career, *Midway* witnessed the introduction of a series of new aircraft. As a result, the composition of her air group was constantly changing. The transformation of *Midway*'s air groups will be traced in some detail and is representative of the composition of the air groups of the other two Midway-class carriers.

In 1946, *Midway*'s air group consisted of 133 aircraft: 65 Vought F4U-4 Corsairs, 4 Grumman F6F-5P Hellcat photographic aircraft, and 64 SB2C-5 Helldivers. In her first Mediterranean deployment, *Midway*'s air group consisted of two Corsair squadrons and two Douglas AD-1 Skyraider squadrons. The Skyraider could carry an amazing 8,000lb of ordnance and it replaced the World War II-era attack aircraft. A detachment of four F6F-5P aircraft was also aboard.

The USN was quick to enter the jet age in naval aviation. During the 1940s and 1950s, the rapid pace of jet aircraft development resulted in many new types entering service and being placed on carrier decks. Many of these were found to be unsuitable and were produced in small numbers. Early jets were difficult to operate off carriers because they were underpowered. This made launch and recovery operations challenging. Since they could not carry heavy loads, early jets operated as fighters with Corsair and Skyraider aircraft being more suitable as fighter bombers. The most common early jets were the McDonnell F2H Banshee and the Grumman F9F Panther, both entering squadron service in 1949.

In this view, *Midway* steams through heavy seas in the Mediterranean in February 1949. Some of the early modifications can be seen. The ship has been fitted with an interim hurricane bow. Four of the 5in./54 mounts have been removed, though the 40mm and 20mm mounts remain. The SK-2 radar on the forward radar mast has been replaced with

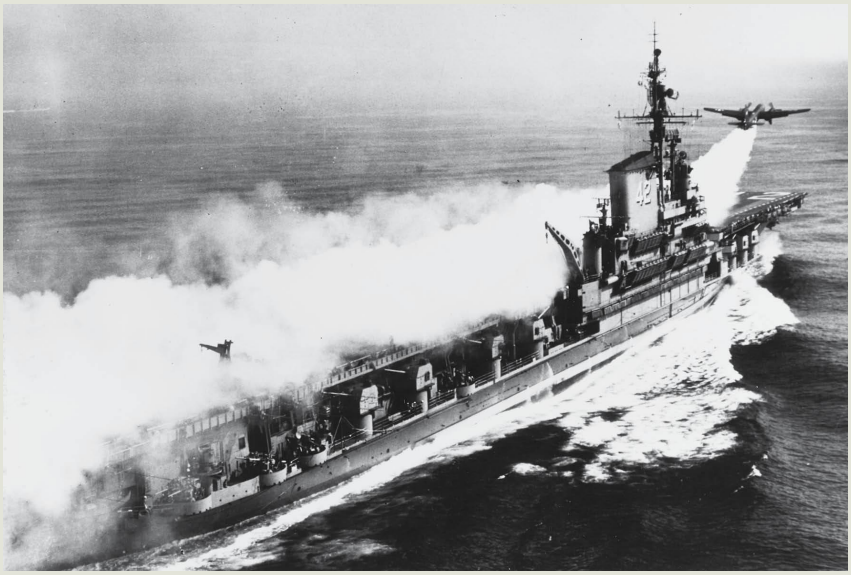
an SR-2 radar. The Mark 37 director now carries a Mark 25 radar. (Naval History and Heritage Command)

Midway's air group continued to evolve as jets entered service. Her second Mediterranean deployment in 1950 included the first jets: the 575mph F9F-2 Panther. Two Corsair squadrons were still aboard, but a third one was replaced with a squadron operating the Grumman F8F-1B Bearcat – the only time these aircraft made a deployment on *Midway*. The final squadron was composed of AD-4 Skyraiders. By 1952, *Midway* carried two squadrons of Panthers, two Corsair squadrons, and a squadron of AD-4 Skyraiders. In late 1952, the last Corsair deployment was recorded and the AJ-1 Savage was added to the air group on a periodic basis.

In this September 1952 view, *Midway* steams off the Firth of Clyde, Scotland, prior to Operation *Mainbrace* with NATO navies. The 40mm mounts have been replaced with 3in./50 mounts, and the 20mm mounts have been removed. For this deployment, *Midway*'s air group included two squadrons of F9F-2 jet fighters alongside the reliable F4U-4 and AD-4 propellor attack aircraft. (Naval History and Heritage Command)

A major consideration in early Cold War USN air groups was the deployment of carrier-launched aircraft that could carry nuclear weapons. This was an existential issue for the USN, since failure to get in the nuclear strike game meant budgetary catastrophe. The future of the Navy's carrier force was at stake if the Air Force was allowed to assume a nuclear strike monopoly. Using what was already in service, the Navy built a viable nuclear strike capability as quickly as possible. The obvious launch platform was the large Midway-class carriers. To carry the large nuclear weapons of the period (the 9,000lb Mark VIII atomic bomb) the latest USN patrol aircraft – the Lockheed P-2 Neptune – was selected. Twelve modified P2V-3C were delivered to Composite Squadron 5 (VC-5) in September 1948 for testing. The Neptunes were large twin-engine aircraft with a 100ft wingspan and a full-up weight of 70,000lb. The idea was to launch the P-2s from one of the Midway-class ships and then use their long range to strike targets inside the Soviet Union or in the Eastern Bloc. After delivering their weapons, the P-2s would recover at a land base or, if necessary, ditch in the sea where their crews could be recovered.

To get off the flight deck, the P-2s were fitted with jet-assisted take-off (JATO) packs. VC-5 also trained to land the P-2s on a carrier and actually made touch-and-go landings on *Franklin D. Roosevelt*. Although one aircraft was fitted with a tailhook, no arrested landings were attempted. In April 1948, the interim nuclear-strike concept was given a full test. Two P-2s were loaded aboard *Coral Sea*. Using JATO, both aircraft took off successfully. Over the next two years, the modified Neptunes from VC-5 and VC-6 took off from all three Midway-class ships and provided the USN with a nascent nuclear strike capability.



Franklin D. Roosevelt launches a P2V Neptune bomber with JATO assist in July 1951. The Neptune provided the USN with an interim nuclear strike capability, which was a critical development in the budget wars of the period. Note the presence of only seven (not the original nine) 5in./54 mounts on the starboard side and that the 40mm quad mounts have already been replaced with 3in./50s. (Naval History and Heritage Command)

Deploying Neptunes on carriers for nuclear strike was only a temporary solution. The first carrier aircraft designed for long-range nuclear strikes was the North American AJ-1 Savage. Prototypes were ordered in June 1946, with the first flight recorded in July 1948. VC-5 received its first AJ-1 in September 1949. This new aircraft featured two piston engines and a jet engine in the tail. Once in service, it replaced the Neptunes. The Savage was deployed aboard the Midway class but only on a temporary basis. It was never popular with carrier commanders because of its huge size, as it clogged up flight deck operations. The AJ-1 was retained in a nuclear role until the mid-1950s, though it operated mostly from land bases. It also served as a carrier-based tanker beginning in 1958 and as a photo reconnaissance aircraft until 1960.

An A-3 Skywarrior is launched from *Coral Sea* in the Gulf of Tonkin in January 1972. The Skywarrior was the ultimate USN heavy bomber designed to perform in the nuclear strike role. By 1972, it was mainly used in support roles. (Naval History and Heritage Command)

The largest nuclear-capable aircraft to operate on Midway-class carriers was the twin-engine Douglas A3 Skywarrior. This was an all-jet aircraft that entered fleet service in 1956. It had a long life, even after being phased out of the heavy attack role, and continued to serve aboard carriers as a tanker, electronic countermeasures, and an intelligence collection platform.

As the nuclear strike capabilities of the Midway class grew, more jets entered service. In 1954, *Midway*'s air group included the all-weather McDonnell F2H-3 Banshee and the first of the second-generation fighters, the swept-wing F9F-6 Cougar (based on the Panther and introduced in 1952). The following year, the air group included two squadrons of Banshees, one Cougar squadron, and one Skyraider squadron.

The first jet aboard the Midway class was a Grumman F9F-2 Panther, like the one here seen aboard *Franklin D. Roosevelt* probably in 1951. Operations in Korea revealed that the

Panther was inferior to the Soviet MiG-15, which pressed the USN to develop swept-wing fighters. (NARA)

Following her SCB 110 modernization, *Midway* was able to operate the supersonic Vought F8 Crusader, the supersonic but less-than-successful McDonnell F3H-1 Demon, and the A3 Skyraider. In 1958, *Midway* went to sea with a squadron each of Crusaders and Demons and three attack squadrons, including one with the North American FJ-4B Fury (a naval version of the F-86), one squadron of AD-6 Skyraiders, and a heavy attack squadron with ten Skywarriors.

In 1961, *Midway* deployed with her first Douglas A4D-2 Skyhawk squadrons, which quickly became the USN's standard light attack aircraft. Another important improvement was the introduction of the Grumman E1B Tracer which provided a significant increase in airborne early-warning capabilities. Two years later, another significant enhancement to *Midway*'s air group took place. Development of the F3H Demon led to the McDonnell F4 Phantom II. This was a versatile aircraft capable of Mach 2.2.

When *Midway* made her 1965 deployment to Vietnam and saw her first combat action, her air group consisted of a squadron of F-4s, one F-8 squadron, two A-4 squadrons for light attack, and a Skyraider and a Skywarrior squadron for heavy attack. Detachments were also present for airborne early warning and photographic reconnaissance. In her second Vietnam deployment conducted in 1971, *Midway*'s air group included two squadrons of F-4s, two squadrons of Vought A-7B Corsair IIs (replacing the A-4s in the light attack role), and a squadron of Grumman A-6A Intruders for all-weather heavy attack. Also, the Grumman E-2B Hawkeye made its first *Midway* deployment and represented a major enhancement in airborne early-warning capabilities. When the Grumman F-14 Tomcat replaced the F-4 Phantom II, they were unable to operate off *Midway* and *Coral Sea* because there were no maintenance facilities to support them and because the ships' jet blast deflectors could not handle them. As a result, these ships were the last to operate the F-4. They also did not operate the Lockheed S-3 Viking ASW aircraft as all other CVs did.

After her 1986 modernization, *Midway*'s air group lost its F-4s and A-7s in exchange for the multimission F/A-18 Hornet. In its final configuration, *Midway*'s air wing consisted of 68 aircraft: 36 F/A-18 Hornets in three squadrons, 14 A-6E Intruders (and four KA-6D tankers) in two squadrons, complemented with a squadron each of Grumman EA-6B Prowlers for electronic warfare, E-2C Hawkeyes for airborne early warning, and a squadron of helicopters.

In December 1954, *Midway* departed Norfolk to conduct an around the world cruise to transfer to the Pacific Fleet. During the first half of 1955, she operated with the 7th Fleet and provided air cover during the Nationalist Chinese evacuation of the Tachen Islands during the Quemoy-Matsu crisis. Upon return to the United States, she went to the Puget Sound Naval Shipyard for her SCB 110 modernization. Returning to service in September 1957, she was homeported in Alameda, California.

As part of the 7th Fleet, she conducted regular Western Pacific deployments, including during the Laotian Crisis of 1961. Her first combat deployment came in early 1965 when she flew strikes against targets in North and South Vietnam. Two of her F-4B Phantom II fighters were credited with the first confirmed kills of North Vietnamese MiGs on June 17, 1965. During *Midway*'s first combat deployment, aircraft losses were heavy – 22 overall including 17 due to combat.

Oiler *Tappahannock* refuels *Coral Sea* in the South China Sea on January 12, 1967 during her third deployment to Vietnamese waters. By this point, the F-4 Phantom II and the E-2 Hawkeye have joined old stalwarts such as the A-3, A-4, and A-1 attack aircraft. (Naval History and Heritage Command)

On her return to the United States, *Midway* went into the San Francisco Bay Naval Shipyard (aka Hunter's Point) for her SCB 101.66 modernization. This was completed in 1970, after which *Midway* conducted a combat deployment off South Vietnam in 1971. During this seven-month deployment, *Midway* flew 6,000 combat sorties and lost only three aircraft.

The following year, *Midway* conducted her third and final Vietnam deployment and saw extensive action. Her air wing participated in the mining of North Vietnamese ports and then Operation *Linebacker* in response to the North Vietnamese Easter Offensive that commenced in March 1972. During this period, 12 aircraft were lost to combat and seven more due to operational reasons. For her efforts from April 1972 through February 1973, the ship and her air wing were awarded a Presidential Unit Citation. In total, *Midway* received five battle stars for service off Vietnam.

Midway changed her homeport to Yokosuka, Japan in October 1973, becoming the first carrier to be permanently deployed outside the United States. This was done in order to have a carrier permanently present in the Western Pacific. *Midway* was off Vietnam in April 1975 when the war drew to a close. As part of a task force with four carriers, she disembarked half of her regular air wing and embarked heavy Air Force helicopters for the evacuation of American and select Vietnamese personnel from Saigon (called Operation *Frequent Wind*).

Midway conducted her first combat deployment to Vietnam from March to November 1965. This view shows that her 5in./54 battery has been reduced to only four – one on each quarter. During this deployment, her air wing included F-4s, A-4s, F-8s, and A-1 Skyraiders, all of which are evident in this view. (Naval History and Heritage Command)

As the forward-deployed Western Pacific carrier, *Midway* maintained a high operational tempo. In August 1976, *Midway* and her strike force

responded to a North Korean provocation at the demilitarized zone (DMZ). In April 1979, *Midway* became the contingency carrier in the Indian Ocean, which was to become an area of high tensions after the Iranians seized the American Embassy in Tehran on November 4, 1979. *Midway* stayed in station in the Indian Ocean until early February 1980.

Midway pictured underway in the Indian Ocean in November 1979 during the Iranian crisis. Note the addition of a BPDMS system on the starboard bow. Even late in her career, *Midway* could still embark a large air wing. Among her 72 aircraft, F-4s, A-7s, A-6s, EA-6Bs, and an E-2 can be seen. One S-3 Viking is parked forward of the bridge, but this aircraft was never part of *Midway*'s permanent air wing. (Naval History and Heritage Command)

After a short respite in Yokosuka, *Midway* deployed again in May 1980. On July 29, *Midway* collided with a merchant ship off Palawan Island. Two American sailors were killed and three wounded. Damage was light, so *Midway* was able to begin another Indian Ocean deployment in August. During this deployment she recorded 118 consecutive days at sea.

When Operation *Desert Storm* commenced in January 1991, *Midway* was one of four USN carriers involved. Operating from the Persian Gulf, she generated sortie rates equal to the more modern ships engaged in the operation. During the Gulf War, *Midway*'s air wing mounted 3,339 combat sorties for an average of 121 per day. No aircraft were lost. With *Desert Storm* brought to a successful end, *Midway* departed the Persian Gulf in March and returned to Yokosuka.

In June 1991, *Midway* began her final deployment. She was dispatched to the Philippines to participate in the evacuation of 20,000 American military personnel and their dependents from Clark Air Base on Luzon which was

heavily hit by the eruption of Mount Pinatubo. She returned to Yokosuka and in August departed her adopted Japanese home for the last time. By this time, she was the oldest carrier in the fleet and was due for retirement. *Midway* was decommissioned on April 11, 1992 in San Diego after 47 years of service.

From 1973 until 1991, *Midway* was based in Japan, the first USN carrier to be based outside the United States. In this view, *Midway* departs Naval Station, Yokosuka, Japan for the last time with sailors forming a farewell message on the flight deck. Note the SPS-49 on the platform abaft the island and the SPS-48 on the mainmast. A Sea Sparrow launcher and a CIWS have been fitted on her port quarter. (US Navy)

Though retired from active service, *Midway* still had a second act. A group from San Diego made a successful proposal to the Navy to preserve the ship as a museum. The proposal was accepted, and in 2003 *Midway* began her final journey from Bremerton, Washington to her new home. She was opened to the public in June 2004 and has been a popular destination ever since. It is almost certain that she will be the only USN supercarrier to be preserved, since all the conventional carriers commissioned after *Midway* have been scrapped and no nuclear carrier is suitable for conversion into a museum ship.

The largest museum ship in the world is *Midway*. Since January 2004 she has been moored in downtown San Diego and has been open to visitors. (US Navy)

USS *Midway* final specifications	
Displacement	53,400 tons standard; 67,000 tons full load
Dimensions	Length: 1,006ft, 3in. (overall); Beam: 141ft (flight deck 258ft, 6in.); draft (full load) 36ft
Machinery	12 boilers, 4 geared turbines
Performance	32kts maximum speed; endurance 15,000nm at 15kts
Crew	Ship's company: 106 officers, 2,006 enlisted; air group: 210 officers, 1,121 enlisted; flag staff: 14 officers, 126 enlisted
Aircraft facilities	2 C 13 steam catapults, 3 deck-edge elevators; aircraft capacity: 65
Weapons	2 Sea Sparrow Mk 25 launchers, 2 CIWS
Radars	SPS-48C 3-D air search, SPS-49 air search, SPS-65 navigation

E DEBUT OF THE HORNET

Coral Sea was the first carrier to fly combat sorties with the F/A-18 Hornet. In March 1986, during one of a continuing series of Freedom of Navigation exercises in the Gulf of Sidra, Hornets from *Coral Sea* flew combat air patrols in support of the exercise. On April 15, 1986 all four Hornet squadrons aboard *Coral Sea* were involved in the suppression of Libyan air defenses by firing 20 AGM-88 High-Speed Anti-Radiation Missiles at targets in the Benghazi area. The same day, *Coral Sea* A-6 Intruders bombed Benina Airfield. In this scene a Hornet from VFA-132 is being directed to one of the ship's bow catapults for launch. Behind the Hornet, *Coral Sea*'s island shows her electronic fit with the flat SPS-48 radar; behind it is the SPS-49 radar. Note the Phalanx CIWS atop the bridge. The two circular devices are satellite communication downlink receivers.

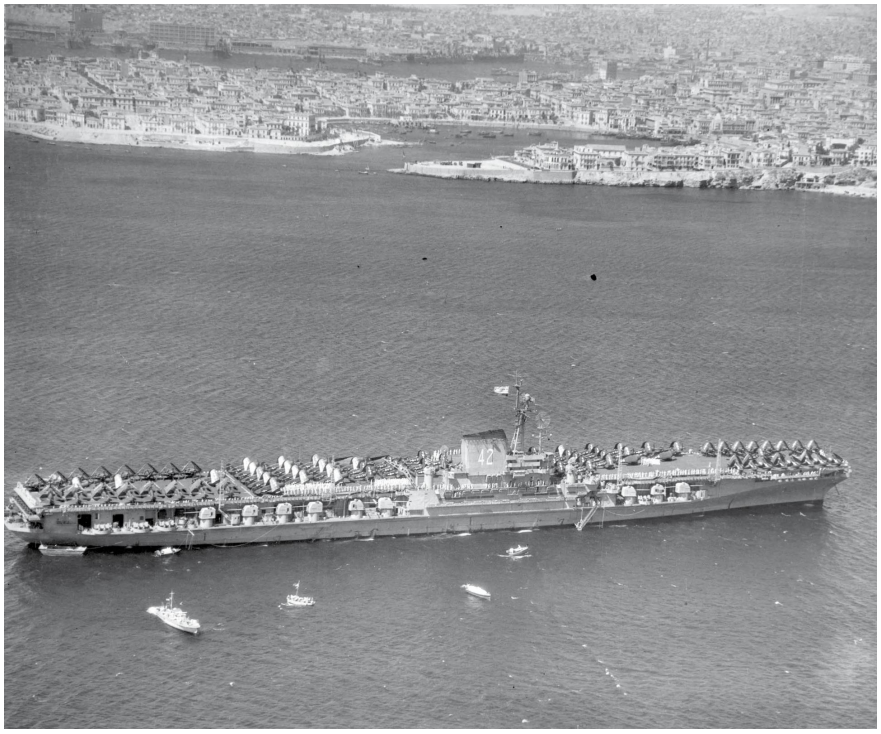
Franklin D. Roosevelt

The second Midway-class large carrier took the name of President Roosevelt shortly after his death in April 1945. Previously, carriers had been named for battles or famous USN ships. This was the first time that a carrier had been named after a president – an unfortunate practice that continues up until today and has been expanded to include other politicians.

***Franklin D. Roosevelt* milestones**			
Service dates	**Conversions**	**Classifications**	**Fate**
Commissioned: October 27, 1945 Decommissioned: April 23, 1954 Recommissioned: April 6, 1956 Decommissioned: September 30, 1977	SCB 110 (April 1954–April 1956) SCB 103.68 (July 1968–July 1969)	CVB 42 (as commissioned) CVA 42 (October 1, 1952) CV 42 (June 30, 1975)	Scrapped 1978

Franklin D. Roosevelt had the shortest career of the three ships in her class. Commissioned in October 1945, the carrier missed World War II. Following work ups and the first jet trials aboard an American carrier in July 1946, *Franklin D. Roosevelt* made her first Mediterranean deployment from August to October 1946. The new carrier made a port call in Piraeus, Greece in September to underline American support for the Greek government which was engaged in a civil war against Communist forces.

The 1946 Mediterranean deployment set the tone for the remainder of *Franklin D. Roosevelt*'s career. Over the next 32 years, she conducted over 20 deployments to the region. In addition to being the backbone of the 6th Fleet in the Mediterranean, *Franklin D. Roosevelt* was a nuclear strike platform. In 1950, she became the first carrier to take nuclear weapons to sea.



On her first Mediterranean deployment, *Franklin D. Roosevelt* was used as a tool of American foreign policy. This is the new carrier at anchor in the Bay of Piraeus, Greece, in September 1946. The world's largest warship does make a strong statement of American power and support. Note her air group composed of Corsairs and Helldivers. (Naval History and Heritage Command)

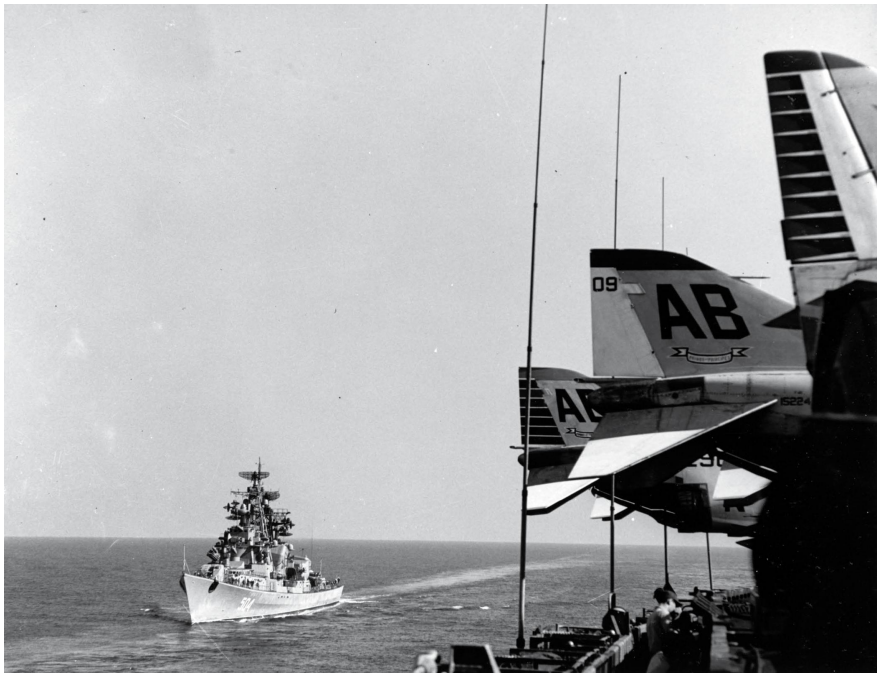
Franklin D. Roosevelt spent almost her entire career assigned to the Atlantic Fleet. The only exception was a Vietnam deployment in 1966 during which the ship and her air wing saw its

only combat action. This is *Franklin D. Roosevelt* steaming in the Gulf of Tonkin in October 1966. Her electronics suite remains unaltered and incudes the SPS-39, SPS-30, and an SPS-10 high on the mainmast. A-4s and F-4s can be seen on the flight deck. (Naval History and Heritage Command)

Franklin D. Roosevelt was the first of her class scheduled to receive a major modernization. Since she was too wide to move through the Panama Canal, she began a cruise in January 1954 around Cape Horn to the Puget Sound Naval Shipyard in Washington. This modernization was completed in two years and when *Franklin D. Roosevelt* returned to service she was the most modern and powerful carrier in the fleet. She returned to the Atlantic Fleet and was assigned a new homeport of Mayport, Florida. From there, she resumed a series of Mediterranean deployments.

In an effort to relieve the burden on Pacific Fleet carriers, Atlantic Fleet carriers were rotated through Vietnam combat deployments. *Franklin D. Roosevelt* conducted her only Vietnam deployment between August 1966 and February 1967. During this period she spent 95 days on station conducting 7,000 combat sorties. Aircraft losses were heavy – eight from combat action and seven from operational causes.

During her career, *Franklin D. Roosevelt* made over 20 Mediterranean and three Atlantic Ocean deployments. This is the carrier in the Mediterranean in June 1971. She is virtually unarmed and mounts only four ineffective 5in./54 mounts. (Naval History and Heritage Command)



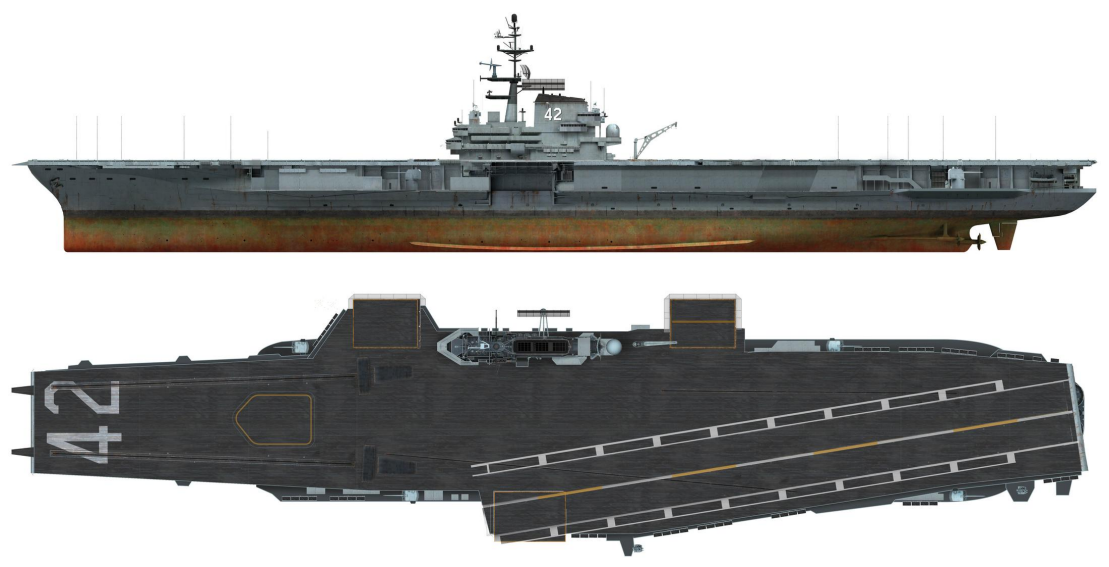
When deployed to the Mediterranean, USN carriers were exposed to almost constant surveillance by Soviet naval units, especially when operating in the Central or Eastern Mediterranean. This is a Soviet Kashin-class guided-missile destroyer passing close by *Franklin D. Roosevelt* in September 1967. (Naval History and Heritage Command)

Franklin D. Roosevelt was scheduled to receive her second extensive modernization based on the SCB 101.68 work performed on *Midway*. After the massive cost overrun of that work, this plan was canceled and *Franklin D. Roosevelt* was given a much more austere $46 million modernization designated SCB 103.68. Work began in July 1968 at the Norfolk Naval Shipyard and lasted 11 months. At its conclusion, the carrier was able to operate the latest strike aircraft in service, the heavy attack A-6 Intruder and the light attack A-7 Corsair II.

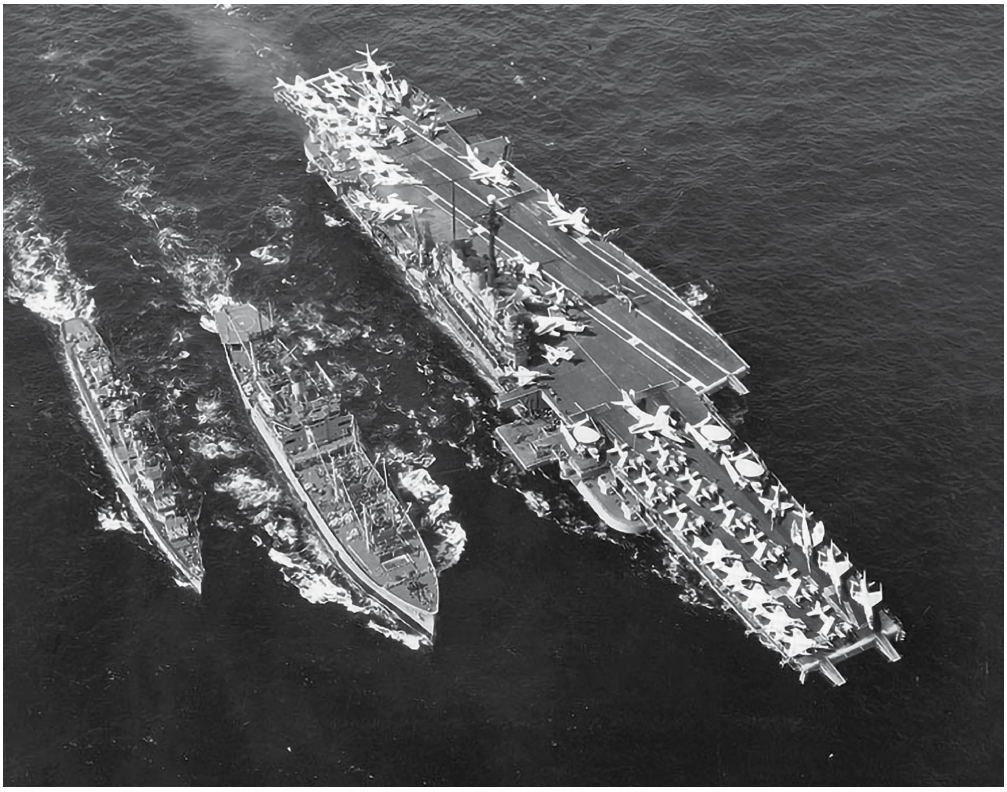
Franklin D. Roosevelt was back in service by May 1969 and in January 1970 resumed her operational routine of conducting Mediterranean deployments. Her most memorable Mediterranean deployment was her 21st, during which the October 1973 Yom Kippur War broke out. Both the USN and Soviet Navy reinforced their Mediterranean fleets to historically high levels in support of their respective allies. Both navies engaged in an extremely tense stand-off in which hostilities seemed a real possibility. *Franklin D. Roosevelt* was one of three USN carriers present. When the United States government decided to reinforce the Israeli Air Force, *Franklin*

D. Roosevelt operating near Sicily was used as a fuel stop for A-4 Skyhawks flying to Israel.

F *FRANKLIN D. ROOSEVELT* IN 1975



This plate shows *Franklin D. Roosevelt* in her last configuration. Her last modernization was an austere one completed in 1969; by 1975 she was the least modern of the three ships in her class. This led to her leaving active service in 1977. The overhead view shows the location of her three elevators. Two C 11 catapults are on her bow. Her electronics fit is obsolescent with an SPS-30 height finder on the main mast with an SPS-10 placed above it. The long-range SPS-43 air-search radar is on its own platform outboard from the stack. Only four 5in./54s remain, one on each quarter, with a single Mark 37 director located above the bridge.



Coral Sea steams alongside stores ship *Bellatrix* during underway replenishment operations in the Western Pacific in April 1962. The destroyer to the left is Gearing-class *Duncan*. Visible among the Carrier Air Group 15 aircraft are seven A3D Skywarrior heavy attack aircraft, F8U-2N Crusaders, some short-lived F3H Demons, A4D-2 Skyhawks, AD-6 Skyraiders, and three WF-2 (later E-1) Tracers. (Naval History and Heritage Command)

Franklin D. Roosevelt conducted her final Mediterranean deployment from October 1976 to April 1977. During this time her air wing included a squadron of Marine AV-8A Harrier aircraft, the first such deployment on a carrier. Also during this deployment, the *Franklin D. Roosevelt* collided with a merchant ship in the Strait of Messina, but damage was light.

By this time, *Franklin D. Roosevelt*'s future was looking uncertain. She did not receive a full second round of modernization, so she was the least modern and capable of her class. The carrier was in poor material condition. In particular, her General Electric turbines gave persistent problems and reduced speed compared to the Westinghouse turbines on her sister ships. The new Nimitz-class nuclear-powered supercarriers were coming online and the Navy did not want any disruption to the funding of those new ships. For these reasons, the Navy decided to decommission *Franklin D. Roosevelt* when the second Nimitz-class unit, *Dwight D. Eisenhower* entered service in 1977.

After returning from her final deployment in April 1977, *Franklin D. Roosevelt* was decommissioned in September. Because of her poor material condition, she was not retained in the reserve fleet, but was sold for scrap in 1978.

Coral Sea passes the USS *Arizona* Memorial in Pearl Harbor in April 1963. Only two 5in./54 mounts remain on the carrier's starboard side. On the main mast are SPS-43 and SPS-30 radars. Among the aircraft parked on deck are several A-3s, many F-8s, and A-1 and A-4 attack aircraft. (Naval History and Heritage Command)

Coral Sea

As the final ship of the class, *Coral Sea* missed World War II, like her sister ship *Franklin D. Roosevelt*, but enjoyed a distinguished 43-year career during which she saw combat action while assigned to both the Atlantic and Pacific Fleets.

***Coral Sea* milestones**			
Service dates	**Conversions**	**Classifications**	**Fate**
Commissioned: October 1, 1947 Decommissioned: May 24, 1957 Recommissioned: January 25, 1960 Decommissioned: April 26, 1990	SCB 110A (April 1957–January 1960)	CVB 43 (as commissioned) CVA 43 (October 1, 1952) CV 43 (June 30, 1975)	Scrapped 1993–2000

In this view from October 1969, a Soviet intelligence collection ship shadows *Coral Sea* in the Gulf of Tonkin. Carriers on Yankee Station were accustomed to constant Soviet surveillance. (Naval History and Heritage Command)

Coral Sea made two Indian Ocean deployments. On her first she was ready to launch combat sorties as part of Operation *Eagle Claw* in April 1980, the unsuccessful attempt to rescue the American hostages in Iran. In this view, A-7E Corsair IIs wait to be launched from *Coral Sea*. Both aircraft wear the distinctive recognition stripes applied to aircraft participating in the operation to provide a means for quick visual identification. (Naval History and Heritage Command)

Coral Sea conducted her first Mediterranean deployment from May to September 1949. In April 1950, the USN achieved a major milestone with the first carrier takeoff of an AJ-1 Savage heavy attack bomber from *Coral Sea.* This demonstrated the Navy's ability to conduct nuclear strike missions from its carriers. With this new capability, *Coral Sea* conducted her second Mediterranean deployment from September 1950 to February 1951. During her next Mediterranean deployment, which began in April 1952, Yugoslavian dictator Marshal Josip Broz Tito embarked on *Coral Sea* to observe carrier operations. Between 1953 and 1957, she conducted another four Mediterranean deployments; on the second, *Coral Sea* briefly embarked Spanish dictator Generalissimo Francisco Franco for a tour.

In early 1957, *Coral Sea* departed Norfolk for her first modernization in Bremerton. After returning to service in 1960, she was assigned to the Pacific Fleet. In September of that year, she commenced her first Western Pacific deployment. *Coral Sea*'s arrival in the Pacific was quickly followed by a widening war in Vietnam. In August 1964, the Tonkin Gulf incident set the United States on a course of direct involvement in the war. *Coral Sea* arrived off Vietnam in February 1965 and conducted a series of retaliatory strikes against targets in North Vietnam. The US air war expanded into Operation *Rolling Thunder* by March and *Coral Sea* was one of several 7th Fleet carriers participating. *Coral Sea* conducted another six combat tours off Vietnam from 1966 to 1975. Her 1972 deployment coincided with the North Vietnamese Easter Offensive, after which targets in North Vietnam were once again struck. *Coral Sea* aircraft also took part in the mining of Vietnamese ports in May 1972, which proved very effective.

In January 1973, the Paris Peace Accords were signed, bringing active American involvement in the war to an end. *Coral Sea* returned to the waters off Vietnam in 1975 when the Communists were advancing on Saigon and appeared ready to bring all of South Vietnam under their control. She participated in Operation *Frequent Wind* in April 1975. The following month, *Coral Sea* participated in the *Mayaquez* incident, in which American forces conducted operations to rescue the American-flag merchant ship and her crew from Communist Khmer Rouge forces off the coast of Cambodia. The operation took place May 12–14 and was successful in retrieving the ship and crew. *Coral Sea* aircraft provided air cover for the operation.

In this view, *Coral Sea* makes over 30kts during a high-speed run on March 1, 1989. The small number of aircraft on deck indicates the photograph was taken during carrier qualifications, not during a deployment. Note the CIWS atop the bridge. (Naval History and Heritage Command)

The Iran hostage crisis of November 1979 drew *Coral Sea* into a new theater of operations. She relieved *Midway* in the northern Arabian Sea in early February 1980. Then in April, aircraft from *Coral Sea* supported an unsuccessful hostage rescue operation inside Iran. *Coral Sea*'s final Western Pacific deployment began in August 1981. The carrier returned to the waters off Iran before going back to her home port of Alameda, California in March 1982.

In 1983, *Coral Sea* was reassigned to the Atlantic Fleet and switched her homeport from Alameda to Norfolk, Virginia. While conducting routine training off Guantánamo Bay in April 1985, *Coral Sea* collided with an Ecuadorian tanker. Damage was bad enough to require two months of repair and prompted the relief of her captain. Following this episode, *Coral Sea* returned to the Mediterranean in October for her first deployment there since 1957.

Coral Sea's 1985–86 Air Wing

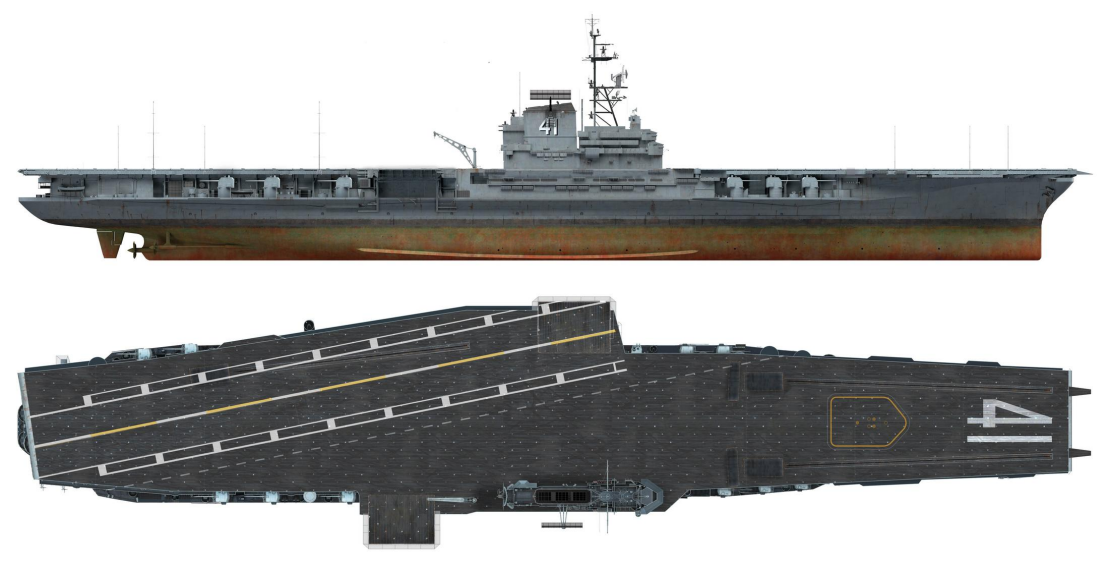
For *Coral Sea*'s 1985–86 Mediterranean deployment, she embarked the newly formed Carrier Air Wing 13. During this period, the centerpiece of the air wing was the F/A-18 Hornet, a multi-purpose aircraft capable of performing fighter and attack missions. For the 1985–86 deployment, four Hornet squadrons were embarked (VFA-131, VFA-132, VMFA-314, and VMFA-323 – the latter two being Marine squadrons). One squadron of A-6E Intruders (VA-55) were retained in the all-weather attack role. Supporting aircraft included Grumman EA-6B Prowlers from VAQ-135, E-2C Hawkeye early-warning aircraft from VAW-127, and utility SH-3H Sea King helicopters from HS-17. A detachment of EA-3B Skywarriors from surveillance squadron VQ-2 was also embarked.

Coral Sea pictured at sea in 1986. Note that the majority of the aircraft on deck are F/A-18 Hornets. The ship is in her final configuration with three CIWS, and SPS-48C and SPS-49 radars. (Naval History and Heritage Command)

Coral Sea's 1985–86 Mediterranean deployment marked the first appearance of the Hornet in the Mediterranean and its first combat action. Freedom of Navigation operations in the Gulf of Sidra on March 24, 1986 saw Libyan forces fire missiles at American aircraft and *Coral Sea*'s Hornets intercept multiple Libyan aircraft that were approaching the task force. In response to a Libyan-sponsored bombing aimed at American servicemen in Berlin, the next month *Coral Sea* Intruder and Hornet aircraft struck targets inside Libya as part of Operation *El Dorado Canyon*. Following this deployment, *Coral Sea* conducted two final deployments to the Mediterranean and the Indian Ocean before returning to Norfolk for the final time on September 30, 1989.

After an almost 43-year career, *Coral Sea* was decommissioned on April 26, 1990. After being sold in 1993, she was moved to Baltimore, Maryland for scrapping. This proved to be a prolonged process because of a combination of financial, legal, and environmental issues. Work was finally completed in September 2000.

G *MIDWAY'S* INTERIM CONFIGURATION, EARLY 1960s



Midway in 1962 was between her two major modernizations. She retains the basic configuration from her SCB 110 modernization with an angled deck and two bow catapults. Of her three elevators, the forward one is still on the centerline and only one is located on the starboard side. All the 3in./50 mounts have been removed, but the 5in./54 battery retains ten mounts, six on the starboard side and four on the port side. An SPS-43 radar has been added on a platform on the stack, joining an SPS-10, an SPS-8A, and an SPS-6 on the mainmast.

The Midway class continued to serve in a front-line capacity even after the USN commissioned larger conventional and nuclear-powered supercarriers. Here, *Kitty Hawk* (foreground), *Midway* (middleground), and *Nimitz* (background) steam together in the Indian Ocean in 1980. Except for a lack of freeboard, *Midway* was about the same size as her more modern counterparts. (Naval History and Heritage Command)

***Coral Sea* final specifications**	
Displacement	48,000 tons standard; 65,200 tons full load
Dimensions	Length: 1,003ft, 8in. (overall); Beam: 121ft (flight deck 236ft); draft (full load) 35ft
Machinery	12 boilers, 4 geared turbines
Performance	32kts maximum speed; endurance 15,000nm at 15kts
Crew	Ship's company: 145 officers, 2,357 enlisted; air group: 260 officers, 1,960 enlisted
Aircraft facilities	3 C 11-1 steam catapults, 3 deck edge elevators; aircraft capacity: 65
Weapons	3 CIWS
Radars	SPS-48C 3-D air search, SPS-49 air search, SPS-65 navigation

ANALYSIS AND CONCLUSION

The Midway class constituted the heart of the USN's carrier fleet during the first decade of the Cold War before the Forrestal-class supercarriers came into service. Until the advent of the Forrestal class, they were the largest ships in the USN and the largest in the world. As the centerpiece of the early Cold War fleet, the Midway-class carriers performed the critical mission of helping to deter Soviet aggression in Europe by both their presence in sensitive areas and their ability to conduct nuclear strikes. They were too important to commit to the Korean War, which was viewed as a secondary theater by the Joint Chiefs of Staff.

By virtue of their large air groups, the Midway class carriers were the USN's premier power projection asset during the first decade of the Cold War. Once modernized, they remained capable power projection platforms as they proved off Vietnam and during the first Gulf War. In this respect, they were not overshadowed by the supercarriers, since the older ships carried almost identical air groups and were able to generate similar sortie rates. Only late in their careers, when they were not able to carry the F-14 fighter and as they aged, did their utility begin to wane. As the most modern of her class, *Midway* served well up until the end of her 47-year career. *Coral Sea* enjoyed a career only a few years shorter, and also proved to be a fully capable power projection asset until the end.

Two of the Midway-class carriers were stalwarts in the USN's air campaign during the Vietnam War. *Midway* made three combat deployments to Vietnam and *Coral Sea* seven. This view dates from February 1965 and shows Task Force 77 operating in the South China Sea. Among the four carriers in this posed formation are (clockwise from bottom) *Ranger*, *Yorktown*, *Coral Sea*, and *Hancock*. (Naval History and Heritage Command)

Their basic design was sound and proved able to receive extensive modernization. As with all USN carriers, the Midway-class carriers were viewed, first and foremost, as offensive platforms. In this regard, they were successful, since the carriers embarked large air groups and could operate the largest aircraft in USN service for their first 30 years of service. As designed, they possessed an enhanced level of protection. Although this was never tested, the ability of the Midway class to take damage would have been considerable and they would have proven difficult to sink. However, like all USN ships of the period, the Midway class would have been vulnerable to damage inflicted by Soviet antiship missiles, which could have gained a mission kill by making flight operations impossible.

The emphasis on protection and the resulting armored flight deck created problems. By carrying armor that high up, freeboard was reduced, which made the class very wet, both on the hangar and flight decks. In heavy seas,

the bow rode into the waves, not over them. Taking water over the bow was a real issue, since USN doctrine called for deck parks, with the bow area being a favorite spot to park aircraft. *Midway* was even more susceptible to unfavorable sea conditions after her last two modernizations.

Coral Sea steams with *Enterprise* in the South China Sea in April 1975. Both carriers were part of the task force assigned to cover the American withdrawal from Vietnam. (Naval History and Heritage Command)

For crew comfort, the ships were substandard when completed and living conditions were always challenging, even late in their careers. As early as 1947, accommodation for both officers and enlisted personnel was noted to be unsatisfactory. The officers' quarters lacked privacy and adequate washing facilities. The crew's living quarters were overcrowded. Some men were forced to sleep in four-tier bunks, which were extremely uncomfortable and made the accommodation crowded. Not least of the problems was that the ships were too hot below decks. Overcrowding was an issue – when first commissioned, the class was designed for a crew of 3,583 but by 1947 this had increased to 4,100. By the time she was retired, *Midway*'s crew had grown to almost 4,900. This was more than just a comfort issue, since under

wartime conditions it could affect the effectiveness of the ships' crew and impact on morale.

In the final analysis, the Midway class was a successful design and the ships recorded successful careers. Their extensive modernization work allowed them to remain fully capable carriers throughout their lives. Modernization to *Midway* and *Coral Sea* made them essentially equal to the Forrestal-class supercarriers. Performing innumerable deployments to flash points around the world and conducting combat operations in two wars are ample testimony to their capabilities. Though somewhat forgotten in the pantheon of American carriers, the Midway-class carriers spent the first part of their careers as the largest warships in the world and then remained the equal in capabilities to the supercarriers that would eventually replace them.

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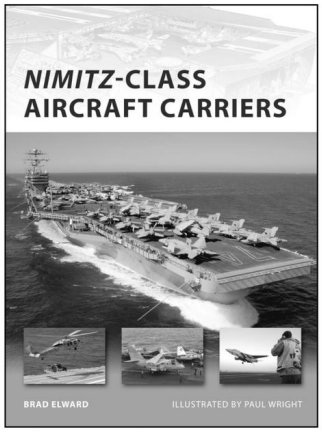

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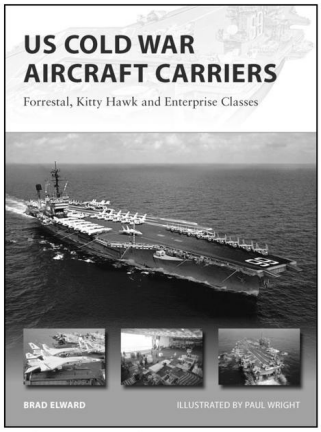

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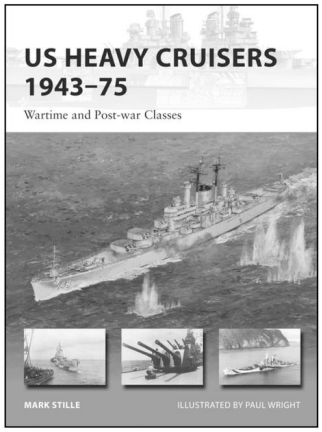

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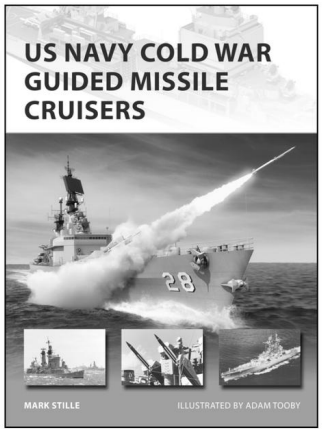

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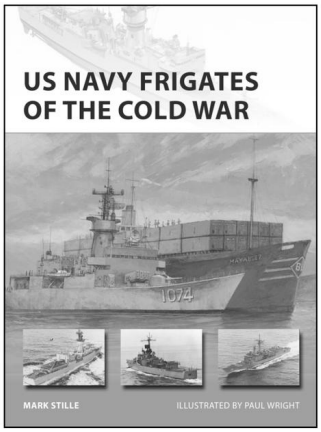

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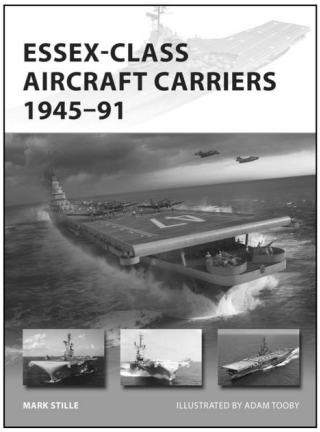

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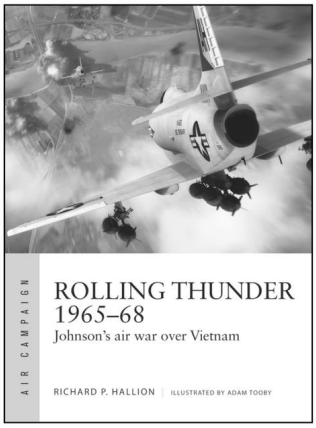

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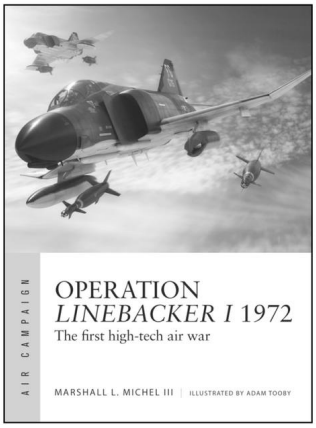

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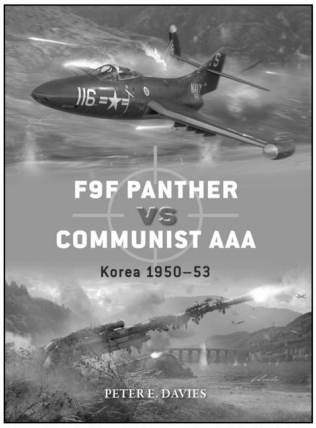

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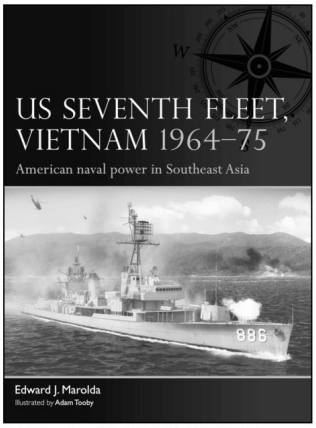

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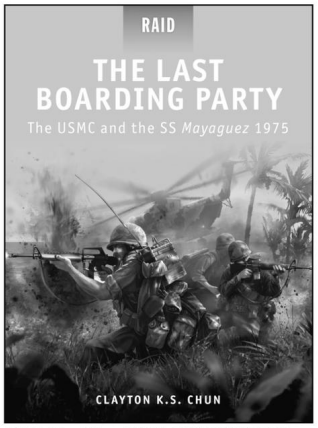

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OSPREY PUBLISHING
Bloomsbury Publishing Plc
Kemp House, Chawley Park, Cumnor Hill, Oxford OX2 9PH, UK
29 Earlsfort Terrace, Dublin 2, Ireland
1385 Broadway, 5th Floor, New York, NY 10018, USA
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www.ospreypublishing.com

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First published in Great Britain in 2024
This electronic edition published in 2024 by Bloomsbury Publishing Plc.

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A catalog record for this book is available from the British Library.

PB ISBN: 9781472860484
eBook ISBN: 9781472860477
ePDF ISBN: 9781472860460
XML ISBN: 9781472860453

Typeset by PDQ Digital Media Solutions, Bungay, UK

Osprey Publishing supports the Woodland Trust, the UK's leading woodland conservation charity.

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